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A BOVRIL SANDWICH

prevents that Sinking Feeling

SCOTIA
Edinburgh
He shewed his word vnto Iacob, and he hath not dealt so with any nation. Psal: 147.
Vbi augusta fronte hau-
mines meyemini.
Pa: 82. 6. 7.
Otia quietis
beati.
FVI
ELIZA
BETHA
HAKLVYTVS
POSTHUMUS
OR
PURCHAS HIS PILGRIMES
Containing a History of the World, in Sea voyages & lande-Trauells by Englishmen & others.
Wherein
Gods Wonders in Nature & Prouidence, The Actes, Arts, Varieties, & Vanities of Men, & a world of the Worlds Rarities, are by a world of Eyewitnesse Authors, Related to the World.
Some left written by M. Hakluyt at his death. Now since added. His also perused, & perfected. All examined, abridged, Illustrated w^th Notes, Enlarged & Discourses. Adorned w^th pictures, and Engraued in Mappes. In fower Parts. Each containing fiue Bookes.
By SAMVEL PVRCHAS B.D.
Aetat. 48.
Anag. Samuel Purcas
PALÆVS CELVM
Imprinted at LONDON for HENRIE FETHERSTON at the signe of the rose in Paules Churchyard 1625

The Title-page of
" Purchas his Pilgrimes"
from a copy in the British Museum.

The Geographical Journal

Vol. LXVIII No. 3 September 1926

PURCHAS AND HIS 'PILGRIMES'

Sir William Foster, C.I.E., Historiographer to the India Office

IN the autumn of 1626 died the Rev. Samuel Purchas,* who in the same year had completed his *Hakluytus Posthumus, or Purchas His Pilgrimes* by publishing as a supplement a fourth edition of an earlier production entitled *Purchas His Pilgrimage*. Despite many defects, his work maintains its importance as a mine of information for students of the history of exploration; and to pass in silence the tercentenary of his death would be ungrateful on the part of those who have benefited by the labours of this clerical geographer.

Details of his career will be found both in the *Dictionary of National Biography* and in the memoir prefixed to the excellent reprint of the *Pilgrimes* published twenty years ago by Messrs. Maclehose of Glasgow. Here it is unnecessary to do more than mention the salient facts of his staid and uneventful life. Born in 1577 at Thaxted (Essex), he was educated at St. John's College, Cambridge, and commenced his clerical career in 1601 as curate of Purleigh, near Maldon, Essex. There he met and married Jane Lease, daughter of a Suffolk yeoman. In 1604 he became vicar of Eastwood, in the same county—a post which gave him opportunities of getting into touch with the seafaring population of Leigh, only 2 miles distant. Ten years later he migrated to the metropolis, having been appointed rector of St. Martin's, Ludgate, and chaplain to George Abbott, Archbishop of Canterbury. These appointments he retained until his death twelve years later.

Purchas commenced author in 1613 by publishing a stout folio of about 800 pages, entitled *Purchas His Pilgrimage, or Relations of the World and the Religions observed in all Ages and Places discovered from the Creation unto this Present*, and dedicated to his patron the Archbishop. Though primarily concerned with religions and customs, it contains a good deal of geography and even history; in fact, it is a kind of world gazetteer. As such it became immediately popular. A second

* Pronounced "Purkas." This appears from the fact that in two entries in the Court Minutes of the East India Company the name is spelt in that fashion, while the entry of his *Pilgrimage* in the Registers of the Stationers' Company and the anagram on the title-page of the *Pilgrimes* both give the author's name as "Purcas." The modern form seems to be Purkis or Purkiss.

edition appeared in 1614, and a third a year later. In 1619 came out another publication, *Purchas His Pilgrim: Microcosmus, or the Historie of Man*, a work, mainly religious, with which we are not here concerned.

Meanwhile the death of Archdeacon Hakluyt in 1616 had put an end to all hopes of that accomplished geographer producing a new edition or continuation of his *Principall Navigations of the English Nation*. He had, however, amassed, presumably for such a purpose, a considerable quantity of material, especially about the voyages to both Indies and to Virginia and the various expeditions in search of the North-East and North-West Passages: in fact, all the more important explorations made since the issue of the 1598–1600 edition of his great work. How this material passed into the possession of Purchas is uncertain, though attempts at explanation have not been wanting. Mr. Bolton Corney, in his edition of *The Voyage of Sir Henry Middleton* (Hakluyt Society, 1855), declared that Hakluyt had nominated "as his editorial successor" John Pory, the translator of Leo Africanus, but that this project came to nothing, and "about the year 1620, under circumstances which are nowhere distinctly stated, the collections formed by Hakluyt came into the hands of the Rev. Samuel Purchas." Sir Clements Markham was bolder in his statements. According to him (*Memoir on the Indian Surveys*, p. 1) Hakluyt was appointed Historiographer to the East India Company in 1601, and consequently "had the custody of all the journals of East India voyages"; on Hakluyt's death these journals were handed over to Purchas, "no doubt with the consent of the Directors," and the death of Purchas, closely following that of Sir Thomas Smythe, the Governor of the Company, would "possibly account for the loss of some of the earliest journals of the Company's voyages." For all this I have been unable to find any warrant in the Company's records. The statement that Hakluyt was appointed Historiographer I have elsewhere shown to be based upon the misreading (by a previous writer) of a passage in the Court Minutes. There is no evidence that the journals were ever placed in his custody or transferred to Purchas; and when the latter applied to the Company in 1622 for permission to make extracts from their records he was apparently a stranger to them, for he is spoken of as "one Purchas, that wrote of the religions of all nations." Moreover, the restrictions then placed upon the loan show that the Company were fully alive to the importance of preserving their journals; and as a matter of fact, several of those used by Purchas are still extant, while the loss of others is easily accounted for by the neglect with which such documents were treated by later generations. That Hakluyt was acquainted with Purchas is highly probable, in view of their common profession and their common interest in geographical matters; but that the former ever intended to entrust his materials to the latter is doubtful, in the absence of any mention of the matter in Hakluyt's

will. On the whole it seems more likely that Purchas applied for them to Hakluyt's executors, who, having no use for such things, readily agreed to make them over to him.

Possessed of this important stock of materials, the reverend gentleman set about his task. But he did so in quite another spirit and in very different circumstances from those in which his predecessor had written. Hakluyt was at once intensely practical and intensely patriotic. Personal aggrandisement had no place in his thoughts, and probably he would never have set pen to paper had he not thought that that was the best means of promoting the objects he had at heart. In common with the best of his contemporaries, his one aim was to make England a great and prosperous country. To Englishmen of his generation there was ever present the menace of that sinister figure at Madrid, King alike of Spain and Portugal, and therefore claiming to be lord of both the Indies. England must be made capable of defying this potent monarch, the champion of Catholicism against the Protestantism so dear to most Englishmen; and for this purpose it was essential that she should acquire wealth by developing her industries and above all her foreign commerce. To promote the latter end became Hakluyt's life-work; and we catch glimpses of his elusive figure everywhere behind the merchants who found the money for voyages of exploration and the seamen who undertook to carry them out. A vital necessity was accurate knowledge of what had already been discovered, and it was here that Hakluyt found a special opportunity of assisting in the work. The publication of the *Principall Voyages* was only part of the help thus afforded, but it was of inestimable value, both in stimulating the national pride in past achievements and in furnishing practical guidance for further voyages. As regards the latter point, one instance may perhaps be given. Sir Thomas Smythe told Purchas that, had it not been for "Mr. Hackluits books of voyages," which, when Keeling's fleet of 1607 was in distress off the West African coast, guided them to seek supplies at Sierra Leone, the ships would have been compelled to return to England, and a loss of £20,000 would have been incurred.

By the time that Purchas set to work the aspect of affairs had changed. The Spanish monarch, while abating none of his claims, was on more or less friendly terms with England; while the power of the Portuguese in the East was steadily crumbling under the attacks of the Dutch, and English commerce with India was firmly established. Much attention was still being paid to voyages of discovery and geography generally; but the satisfaction of the demand for information on such topics had become a matter of literary rather than of patriotic interest. Purchas was curiously self-centred (as shown by the personal note struck in the titles of all his works), and one suspects that he was by no means indifferent to the advantages likely to accrue from the publication of a notable book. A more modest man would have been content to confine

himself to a continuation of his precedessor's work; a wiser one would at least have measured out the ground beforehand and have undertaken only as much as he could hope to perform efficiently and within a reasonable compass. He had over 175 manuscript accounts of voyages and travels, many of them lengthy, and thus had ample material for a work as long as Hakluyt's, if he had limited himself to an account of the expeditions that had taken place since the publication of the *Principall Navigations*. Instead of this, he planned a grandiose work, which should embrace all the chief voyages that had ever been made and should supersede not only Hakluyt but all other writers on the subject. So slight was his comprehension of what this would entail that he expected to get all his matter into two folio volumes; and it was not until he had been at work for some time that he found it necessary to split each of those volumes into two parts, thus doubling the size of the work. Even then travels in Europe proper, which he had intended to include, were crowded out; while many a precious manuscript was reduced almost to a skeleton in order to make room for a digest of a work already available in print. His lack of judgment was equally displayed in the manner in which he handled his "confused chaos" (to use his own words) of materials. Hakluyt was an excellent editor; with calm good sense he pared away the superfluous, but never damaged the essential. Purchas, on the other hand, slashed his narratives in a way that seems at times haphazard, retaining much that might well have been omitted and omitting much that was of importance. Many of his notes are trivial intrusions upon the reader; and most of his editorial contributions go unread.

We must, however, give him credit for having been indefatigable in his search for materials. In dedicating to the Archbishop of Canterbury the final edition of his *Pilgrimage* he says that he had drawn upon more than 1300 authors; and in addition to consulting all the printed works he could find, he sought diligently for manuscript accounts of recent voyages, besides obtaining oral testimonies from those who had taken part. To the East India Company he applied in February 1622 for permission to see such journals as were in the possession of that body, particularly that of Sir Thomas Roe. Apparently some objection was anticipated to the publication of details of the broils between the English and the Dutch; but on this point the reverend author was most accommodating, for he assured the Company that "he will sett them downe otherwise than they lie in the journalls." His application was granted, on condition that he extracted only "what is proper to a history and not prejudiciall to the Companie," and as a further precaution, it was ordered that his notes should be perused by the Deputy Governor before they were carried out of the house. Later, in October, 1624, he begged for the loan of a further journal, and this was accorded upon his giving a receipt for it and undertaking to return it without undue delay.

It is time now to look at the work itself. According to the original

plan, the first volume was to deal with the world as known to the ancients, the second with the regions more recently discovered. Roughly the arrangement was to be geographical; but since so much of the matter consisted of extracts from actual journals, a rigid adherence to this scheme proved to be impracticable. Much about Southern Africa, for instance, was naturally to be found in the accounts of expeditions to the East Indies; nor could the voyages of circumnavigation be split up into the sections to which the various countries were allotted. Further, since the work had to be printed off in small instalments and was in the press four years, materials that came to hand during that period had to be fitted in without much regard to the original plan. Of the first volume the opening section or "book" contains "antiquities and generalities," including much about the religions of the world and a disquisition on the travels of the Apostles, in the course of which the author discusses the question whether America was then inhabited (concluding that probably it was not). This section, by the way, was one of the last to be compiled, with the result that it had to be paged separately and provided with a special index. The second book deals with voyages of circumnavigation; the third, fourth, and fifth with English voyages to the East Indies; the sixth and seventh with Africa; the eighth with Palestine and Turkey; the ninth with Persia, Arabia, India, and Africa; and the tenth with Japan, India, Persia, Turkey, the Malay Archipelago, and Brazil. This book, Purchas tells us, contains material that came to hand later, "and is therefore rather a supply to all then any well-ordered part of the worke." The second volume opens with two books devoted to travels in Tartary, China, Japan, and the Philippines. The third and fourth books relate the voyages in search of the North-East and North-West Passages, and deals also with Russia, Iceland, and Spitsbergen. The next three sections take us to the West Indies, Mexico, and South America. The eighth book not only deals with Florida, Mexico, Central America, and Canada, but makes a start with the Virginia voyages. The ninth continues the story of these, and includes also Gates's expedition to the Bermudas. Of the tenth the first part is devoted to New England, Nova Scotia, and Newfoundland; while the second narrates the contest with Spain, including the fight with the Armada, Drake's expeditions to Portugal and Cadiz, and the voyage of the Earl of Essex to the Azores in 1597.

The illustrations consist mainly of maps, most of which were copied from Hondius, though other sources were also drawn upon, as in the case of Baffin's map of India. A special feature of the work is the engraved title-page. This contains, at the top full-length figures of King James and Prince Charles on the one side, and of the late Queen Elizabeth and the late Prince Henry on the other. The space between them is filled with representations of the Israelites marching towards a vision of the New Jerusalem, of the Gunpowder Plot, and of the defeat of the Armada.

The last mentioned is labelled *Dux femina facti*, and is evidently intended as a compliment to the late sovereign; while the inscription on the companion sketch (*Divinatio in labiis Regis*) shows that it was meant as a piece of flattery towards James I., who believed that the detection of the Plot was due to his perspicacity. At the bottom of the page, between maps of the two hemispheres, is a portrait of the author, at the age of forty-eight, with underneath an anagram (*Pars sua celum*) of his name. Below this again appears the publisher's mark: "Imprinted at London for Henry Fetherston, at the signe of the Rose in Pauls Churchyard, 1625." The centre of the page is occupied by the title of the work, set forth at great length; and this is flanked on either side by two series of medallion portraits, thirty in all, of famous travellers and voyagers, beginning with Noah (represented by his ark) and going down, through Nebuchadnezzar, Alexander the Great, the Apostles, Tamberlain, King Canute, Richard I., Columbus, Cabot, and Magellan, to Drake, John Davis, and other of his contemporaries. This remarkable piece of ingenuity is missing in most of the extant copies of the work, though in some cases it has been replaced by a facsimile executed in 1846.

The labour of preparing the text must have been enormous. As printed, the four folios contain, with indexes and preliminary matter, 4262 pages; and since each page holds about a thousand words, the total number of the latter must be at least $4\frac{1}{2}$ millions. It may be said with confidence that so large a work had never before been printed at an English press. It was of course worked off on hand presses in small instalments; and apparently the author did not read the proofs himself, since he tells us that the page headings were often inserted by "the corrector," and that many errors were due to his own "absence from the presse." The printing commenced in August 1621, and on December 11 in the same year the work was registered at Stationers' Hall. To "the adventurous courage" of his publisher, "so long to beare this my heavy world at such expenses," Purchas pays a well-deserved tribute; but we must do the same justice to the author himself. Except for some help afforded by his son, the whole task of copying, abridging, and annotating fell upon his shoulders, he being unable to maintain "a vicarian or subordinate scribe." During the preparation of the work he was forced to live "in great part upon exhibition of charitable friends and on extraordinary labours of lecturing (as the terme is)," for his regular stipend was insufficient to meet the many demands upon his purse. "It had not beene possible," he continues, "for me in London distractions to have accomplished so great a designe, but for the opportunities of His Majesties Colledge at Chelsie,* where these foure last summers I have

* Founded in 1610 by Dr. Sutcliffe, Dean of Exeter, for the maintenance of a body of clerical fellows whose duty was to be to defend the established religion, though two of their number might be men not in holy orders, who were to write the annals of their own times. The college was only partly built, and after the founder's death it came to

retired myselfe (without pulpit non-residence) to this worke." It is only fair, when blaming the author for many shortcomings, to remember the vast extent of his work and the difficulties under which it was produced.

At last, early in 1625, the collection was ready for publication. On January 10 Purchas waited upon the Court of Committees of the East India Company and duly exhibited his volumes; whereupon a gratuity of a hundred pounds was bestowed upon him, and an order was given for the purchase of three sets of the work. He had composed an epistle to the Company, dealing with the injuries received from the Dutch in the East Indies; and this he proposed to insert. The Company entirely approved; but the printer demurred, fearing to be called in question if this dangerous topic were introduced, and after some attempt to move him by the offer of money, the proposal was dropped, though a mild "note touching the Dutch" appears at the end of the address to the reader. To King James and Prince Charles (the work was dedicated to the latter) the proud author had already presented copies of his "voluminous twinnes"; and he tells us that His Majesty, in accepting the gift, promised that the reading of them should be "his nightly task." He also asked whether the *Pilgrimage* was included, and, pointing to a copy of that work in his bedchamber, said that he had read it through seven times. This hint was not lost upon Purchas, who at once busied himself in preparing a fresh edition, to range with the four volumes of the *Pilgrimes*. Soon the patient printers were again at work; and some time in 1626 the volume appeared—a portentous affair of over 1100 pages and well over a million words. It has never been reprinted, and in these days it is seldom opened. For us its most valuable feature is the supplement, in which Purchas printed some matter which had come to hand too late for insertion in the *Pilgrimes*. It consisted of (1) extracts from Sir Jerome Horsey's account of his experiences in Russia (this narrative has since been printed in full from the original MS. by the late Sir Edward Bond in his *Russia at the Close of the Sixteenth Century*: Hakluyt Society, 1856); (2) William Methwold's description of the kingdom of Golconda, etc.; (3) an epitome (with additions) of the "Saracenical Historie" of Al-Makin, taken from the Latin version published at Leiden in 1625.

The issue of the *Pilgrimage* was followed within a few months by the death of its author. Hitherto the date has only been known approximately, from the fact that his will was proved on 21 October 1626; but by the kindness of the Rev. Lewis Gilbertson, the present rector, I have learnt that the registers of St. Martin's, Ludgate, contain the following entry: "1626, September. The last day was buried Mr. Samuell Purchas, our parson." Presumably the interment took place in the

grief for want of an endowment. Charles II. in 1667 gave the building and its grounds to the Royal Society, but afterwards bought the property back again, and the present Chelsea Hospital was erected on the site.

church; but that building was burnt down in the Great Fire, and the present edifice, which was erected by Sir Christopher Wren, contains no monument to the most celebrated of its rectors.

Purchas was only about forty-nine at the time of his death, but apparently his incessant labours had worn him out. In the preface to the *Pilgrimage* he complains of his weak body; and he seems also to have had for a time some harassing money troubles, due in part to the death of a brother-in-law, whose entangled affairs he had to regulate, besides providing for the fatherless family. Anthony à Wood (*Fasti Oxonienses*, ed. Bliss, part i. col. 363) repeats some gossip about his having brought himself into debt by the publication of such expensive works, but contradicts an allegation that he actually died in prison on this account. As a matter of fact, his will shows that he was fairly well off at the time of his death. Another statement made by the same writer is that the King (he does not say whether this was James or Charles) had promised Purchas a deanery shortly before his death. This may explain Purchas's own statement, in the preface to the *Pilgrimage*, that King James, shortly before his own death, was pleased "to impose another taske on me, by an honourable messenger, with promise of reward, which . . . was buried (with those hopes) in His Majesties grave." The nature of this fresh task does not appear.

Anthony à Wood tells us that our author was "by some stiled our English Ptolemy." This is as inapt as such comparisons usually are. The best we can say of him is, in the words of the late Sir Walter Raleigh, that "the inestimable value of his materials has given Purchas a secure place beside his greater predecessor."

SUMMER IN NORTH-EAST LAND, 1924: THE CLIMATE AND SURFACE CHANGES

K. S. Sandford, Department of Geology, University Museum, Oxford

Introduction.

THE paper deals with the summer climatic conditions in North-East Land, together with their effect on the cap of ice which covers the land; it is neither a precise meteorological description nor a "long-period observation," but an attempt to describe the weather and its effects during the longest period yet spent in the island—in all, scarcely a month.

North-East Land is covered by a dome of ice rising rather more than 2000 feet above sea-level. It is remote from the Gulf Stream which washes the shores of Western Spitsbergen.

i. *Previous Exploration.*—A. E. Nordenskiöld (8) * made a traverse

* Bracketed numerals in the text refer to bibliography at end of paper.

from the north-east corner to a point about halfway down the west coast in the spring of 1873. On this journey, which was a hurried one, taking place in May and June, atmospheric conditions were bad and called for notice by the explorer in his book. In particular he referred to the dry and powdery nature of the snow, which was blowing almost incessantly and hampered his party considerably, while persistent fog and mist added to his troubles. He also mentions showers of ice-grains with watery outer layers, mixed with small round snowflakes, at a temperature of $-4°$ to $-5°$ C., attributing the presence of water mixed with ice at such a temperature to the precipitation being derived " from a stratum of cloud formed of over-cooled water vapour " (*op. cit.*, p. 255).

Nordenskiöld's chief concern, however, was with the surface over which he was advancing ; for the ice was honeycombed with dangerous crevasses which, being entirely masked at the surface, rendered his advance hazardous in the extreme.

After this expedition the interior of North-East Land was left alone until 1911, when the Schröder-Stranz Expedition made its unfortunate attempt to cross the interior from the north coast. The expedition ended in disaster, mostly through inexperience, the exploring party being lost and no trace seen in North-East Land until 1923, when its tent-bag was found on North Cape (1).

In 1923 the Merton College Arctic Expedition made determined efforts to land with a view to exploring the interior, but was prevented from doing so by pack ice and adverse conditions. The attempt had to be abandoned, and the sledging party was landed in the north-east corner of the main island of Spitsbergen (New Friesland), an important traverse being made to the west coast (1).

It should be added that a number of trigonometrical stations were established on the west and north coasts of North-East Land by the Swedish Mission of the Arc of Meridian Survey in 1899–1902 (2), but no attempt was made on the interior.

ii. *The Expedition of* 1924.—In 1924 a further attempt was made by the Oxford University Arctic Expedition, which was organized and led by the leader of 1923 (Mr. George Binney), supported by Mr. H. M. Clutterbuck, both of Oxford.

The initial efforts were frustrated by pack and bay ice, and by shoals and reefs on the north-west coast of North-East Land ; but finally two parties were landed near the north side of the mouth of Wahlenberg Bay,* halfway down the west coast, on July 22. These were the northern and central parties : at a later date a third (southern) party was landed on the east coast and crossed the island to the south side of Wahlenberg Bay.

iii. *General Remarks upon Meteorological Conditions experienced in*

* Places, etc., mentioned in the paper are marked on Map I. within the area of the map.

North-East Land.—Within a few days of leaving its base the central party, advancing eastwards into the interior, was well aware that the winds experienced had a special local significance in that they came from the north, from the higher parts of the dome of ice along the southern flank of which the party was travelling, sometimes as gentle breezes, sometimes with great velocity. Observations of clouds, mist, and fog told the same story, and accordingly a specially detailed record of winds and other data was kept by the writer throughout the journey, while the leader, R. A. Frazer, devoted special attention to aneroid barometer readings.

Blizzards of considerable duration and intensity were experienced.

The northern party, travelling on its outward journey roughly parallel to the west coast, experienced winds more variable in their direction, but on reaching the northern part of the dome and during the return journey across it they met consistent winds and blizzards from the south and west. J. R. T. Aldous, W. B. Carslake, and F. A. Montague brought back most valuable observations.

The southern party traversed the eastern part of North-East Land, and the wind directions observed are of special value when compared synchronously with those recorded by the other two parties; they show that the meteorological conditions were of the same type.

There is good evidence of the existence of a considerable depression of the ice running northwards from the eastern end of Wahlenberg Bay to Riips Bay (north coast). The area east of Wahlenberg Bay forms a great saucer-shaped ice depression with a broad rim, about 2000 feet high, which forms a wide surrounding belt and falls to the north, east, and south coasts.

The island ice (5) * of North-East Land thus falls into three marked areas, chiefly owing to the great eastern extension of the fjord of Wahlenberg Bay:

1. The area north of Wahlenberg Bay and east of Riips Bay (investigated by the northern and central parties).

2. An eastern part lying east of a north-and-south line through the head of Wahlenberg Bay (traversed by the southern party).

3. The area lying between the south side of Wahlenberg Bay and the south coast, unexplored.

The reader should bear in mind these regions of the island ice, in particular the depression † between Riips Bay and Wahlenberg Bay and the great saucer-shaped depression east of the latter, since they have

* The ice-dome of the interior, unbroken by nunataks; a true "cap," with a gently undulating or nearly flat but otherwise featureless surface. In part comparable to the old term "inland ice."

† A depression was seen from the head of Wahlenberg Bay, running northwards, but investigation was out of the question; also, near its farthest point, the central party saw cloud rising from "dead ground" to the east.

a definite effect on the flow of air. The part we are to deal with is almost entirely that to the north of Wahlenberg Bay.

It will be shown that the area traversed by the northern and central parties tends to support winds which radiate from its higher central part; that special meteorological conditions exist; that these may, at times, be overcome by stronger forces from outside. Finally, it will be shown that the conditions, especially wind and temperature, have a most marked effect on the distribution of snow and on the surface of the ice.

Barometric Pressure and Wind.

During the period of the journeys in North-East Land between July 22 and August 17, the sea-level pressure in the Spitsbergen archipelago, as shown in the pressure chart (not reproduced) from records at Base Camp (Liefde Bay) and M/S. *Oiland*, varied, to the nearest 0·1 inch, between 30·0 and 29·7 in the earlier part of the time, but dropped on August 4 below 29·6, then completely recovered, to fall again to 29·1 on August 9. This depression, bringing cloud and rain, but little wind, over the whole region, was succeeded by a rapid recovery, which slackened later and was broken by minor pressure oscillations accompanying severe blizzards between August 10 and 13 experienced by the sledging parties in North-East Land from different directions, to be discussed in detail later. Aneroid readings were taken from which, in comparison with the sea-level pressures, a profile of the ice dome from Wahlenberg Bay to the north coast has been constructed (to be published in another paper). For access to the records of Base Camp and of M/S. *Oiland* I am indebted to F. Tymms.

The pressure chart also gives indications, up to August 1, of a lag in the pressure in Hinlopen Strait behind that at Liefde Bay, and also behind the pressures recorded on the ice dome in North-East Land, when allowance is made for altitude. The oscillations were of much the same magnitude, but pressure was higher in Hinlopen Strait (M/S. *Oiland*), but after August 1 the oscillations are almost identical and synchronous.*

In general it would seem that local pressure conditions have a very definite effect on winds on the cap of ice, being the effect that would be expected if the area were permanently one of high pressure, as Greenland and Antarctica appear to be (6). Here however we have oscillating pressure, controlled for the most part from outside, with winds blowing down the sides of the dome as pressure increases, suggesting that there is a modified and specialized system working in this small area.

Judging from the wind directions recorded by M/S. *Oiland*, outside winds tend to be "cushioned off" by the air over the cap of ice—unless the lowering of pressure with which they are associated is particularly deep.

* The higher pressure in Hinlopen Strait than east and west thereof would be accounted for if cold air, gravitating down from the highlands, accumulated in the Straits and was not easily dislodged by warm winds from outside.

With a falling pressure there appears to be little tendency for air to flow down the sides of the ice dome, and at most gentle and intermittent breezes were experienced.

With a rising barometer air starts to flow downwards and outwards, and continues to do so, sometimes with great velocity, until equilibrium is restored—as it apparently is by the establishment of uniform high pressure or by the relief of high pressure and the initiation of another depression.

Viewing the evidence provided by the barometers then we have a curious result: there is no "fixed anticyclone" (7) as in the case of

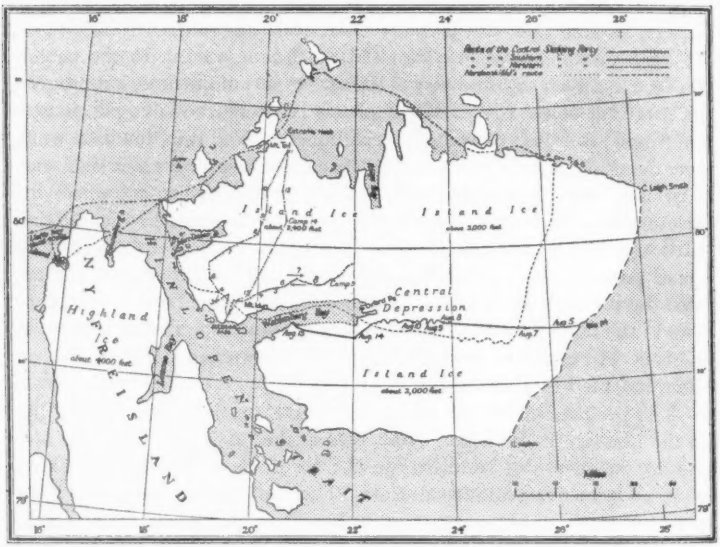


Figure 1. *Sledging routes.*

continental ice; the area takes part in the general oscillations of pressure, but in its answer to the stimuli the local atmosphere has a function of its own which, in the production of outward-flowing winds, performs the function of a glacial anticyclone to a marked degree (as will be seen later).

The sudden cessation of a high wind at a certain point in the increase of pressure is most strikingly illustrated on July 31 (central party, Camp VII.). For many hours a high wind had blown from the north (down the flanks of the dome), and at 03.00 hours had reached almost gale strength, the barometer having crept up to 28·42 (02.15 hours). The conditions were the same at 03.50 hours, with the barometer at 28·44, but at 04.00 hours there was a *dead calm*. Thereafter the barometer continued to rise slowly, but there was no return of the north wind that day.

There was a similar abrupt conclusion of the blizzard of August 10–13 (see later).

Lastly, attention must be given to the relations between pressure and wind from August 2 to August 14, during which time North-East Land was subject to a great depression from the south-west, as already mentioned.

At certain definite stages in the movement of this depression the central party experienced south-west winds, *i.e.* winds flowing across part of North-East Land from outside, instead of in the opposite direction, as at all other times.

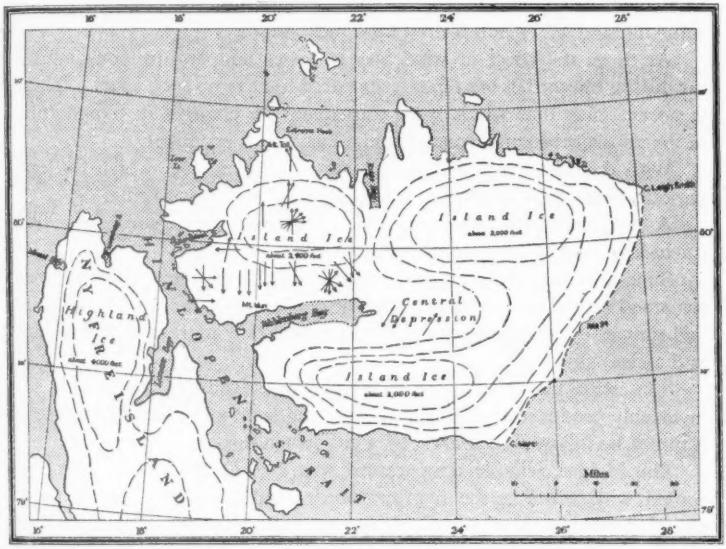


Figure 2. Observed winds shown by arrows.

As the barometer fell, from August 2 till early on August 4, a dead calm reigned, with occasional rain and puffs of wind from the south-west, as will be described later. Almost as soon as the barometer turned on August 4 to rise rapidly throughout that day and part of the next, the air-flow was reversed, and a north-north-west wind, at times strong, blew down from the dome and was accompanied by frost and sunshine. A depression made itself felt again on August 7, and the above process was repeated—south-west breezes, rain, cloud. These conditions were maintained until a little after the barometer had again turned (August 10). Then the full effect of the reinstatement of former conditions was felt. A fierce blizzard swept down the flanks of the dome, being experienced from different directions but with the same significance by northern,

central, and southern parties. It lasted in the north-west part of North-East Land (northern and central parties) about seventy hours, and, as stated above, ended abruptly. The relation of pressure and wind in this case was painfully obvious.

Precipitation and Temperature.

Throughout the period of sledging, temperatures below freezing-point (except during blizzards) were in the minority. This was to be expected in summer, but hardly to the degree experienced.

Cloud (*cf.* stratus) had a marked association with high temperatures, whereas with sunshine and a clear-sky frost usually supervened, at any rate when the sun was northerly ("night"), though there was frequently some melting as the sun neared the south (midday).

At times the effect of wind was to lower temperature considerably (as during blizzards), but often it appeared to have no such effect. There is no evidence that winds were consequent on changes in temperature of the air over the small coastal land areas, and it is unlikely.

With the plus-temperatures (C.) came mist and fog, which for long periods were dense, rendering travelling little more than futile.

A careful analysis has been made of the relations of sunshine, cloud (including mist and fog), and temperature.

Sun, clear sky, and frost were associated. The surface of the ice often remained hard and frozen for some little time after the air temperature had risen above freezing-point; this was especially marked with sunshine and a clear sky.

Sun, with thaw, but with a temperature falling towards zero C., invariably produced fog, which disappeared soon after zero was passed; it might be followed, however, by wind-driven mist.

The highest reliable temperature was 8·5° C. (northern party, recorded with whirling the hygrometer dry bulb, but the central party recorded nothing above 5·8° C. The northern party recorded a minimum of −4·5° C., and the central −5·5° C. During blizzards temperatures were certainly lower, but readings could not be obtained, despite the precautions taken.

The northern party experienced about three really fine days (*i.e.* sunshine and little wind), about six of blizzard, and about six of fog, often dense, and mist. The central party, more remote from the coast, had a less amount of *dense* fog (about five days), about five sunny days, the same amount of blizzard, and many days of dull weather, often with mist. On account of lack of space the full records cannot be published here, but the following interesting observations, recalling the severer conditions of Antarctica and Central Greenland, should certainly be noted; they were made only by the central party at Camp IX.:

On August 4 the heavy bank of cloud (brought up by the depression from the south-west), which had been lying like a warm blanket over the country, was rolled back, the sun shone and temperature fell rapidly,

conditions becoming as radiant as they had been dull. With a cloudless blue sky, a temperature of −3·5° C., and at first no wind, a shower of lath-shaped crystals of ice, about $\frac{1}{8}$ of an inch in length, was experienced, lasting about four hours. After a time the shower was accompanied by slight puffs of wind from the north, and finally a strong breeze from north and north-north-west swept ice-crystals and small quantities of snow from a cloudless sky, the temperature in the meantime having fallen to −4·7° C. A reconnaissance on ski was now made from Camp IX. northwards on to the upper part of the dome, where the surface was found to be much striated and abraded by wind action.

Mist and fog certainly played a big part in the weather of North-East Land in July and August, 1924, and with them rain was recorded a number of times. Rain was associated particularly with the great barometric depression from the south-west, and was at times heavy; but it also accompanied dense fog and mist at other times. For the greater part of their journeys both the survey parties were at about 1000 feet above the sea, and at times considerably more. Although rain is experienced in most parts of the Arctic at this time of the year, its occurrence on a number of occasions at a considerable altitude is of some interest.

Nordenskiöld's experience may be recalled (see Introduction, p. 255 (8)).

The snow observed by the sledging parties in 1924 was sometimes of the type he described, especially during blizzards, when it was mixed with very fine snow-dust, which had remarkable powers of penetrating clothing and of finding its way into almost any crevice. The watery ice-grains were not observed. Temperatures above 0° C. were noted on the occasions on which rain fell.

Nordenskiöld's record of temperature is also of interest (see (8), p. 254). The lowest "approximate mean temperature on the Inland Ice" for any day is −7·5° C.; a temperature above freezing-point is once noted (0·4° C.); at the same time the temperatures recorded by his ship in Mussel Bay (North New Friesland) were mostly above zero, the highest 3·83° C., the lowest −3·09° C.

Cloud.

Lower Cloud.—Of lower cloud, apart from surface fog and mist, no great variety was noted by the two survey parties, but it has an important bearing on surface conditions, and deserves close attention.

During the long periods of mist and fog no observation was possible, but it was evident that mist with wind, and fog with calm, often represented a thick bank of stratus settled on the dome down to a certain level. A party situated at this level had unimpaired visibility of country below its own height and little or none in other directions.

Dense stratus, with the plus-temperatures which usually accompanied it, was frequently followed within a few hours by surface fog. In

fog white "fog-bows" were noted on a number of occasions, at any rate by the central party.

The dome south of Wahlenberg Bay was under the observation of the central party for nearly the whole period of sledging. A feature which attracted attention was the behaviour of small patches of stratus resting on the higher parts of the slightly undulating ice surface. In calm weather, with sun, these patches were seen to rise from the surface in mushroom shape. Sometimes several such layers rising successively were seen to lie one below the other, coalescing where they were thicker (in the centre of the "mushroom"), and forming a "cedar tree" cloud with very attenuated borders. These clouds rose to high altitudes, and both in the variety of colour, when the sun played upon them, and in their delicate structure were exceedingly beautiful (11).

On more than one occasion low stratus clouds were seen by the central party to be flying radially, and very fast, from the higher parts of the dome to the north of the party's course. One such occurrence followed the sudden cessation of high wind noted under "Pressure and Wind," at Camp VII. (central party). The author took the greatest care to allow for perspective, and therefore is confident of the correctness of his observation. First a cap of cumulo-stratus cloud was seen moving *westward* from its position to the north of the camp, and a few minutes later is noted "low cloud over the dome to the north and north-west [of the camp] scudding away to east, south, and south-west and intermediate directions—radiating." On the surface there was little wind, but after a time a steady breeze from north-east to east settled in.

The observation is supported by another, taken at a range of many miles—*i.e.* at the head of the Wahlenberg Bay on August 27, when, over the approximate site of Camps IX. and XI. (central party) "radial cloud-blowing off the northern ice-cap" was noted. In this case it had been preceded by a wind blowing off the dome at a height of more than 1000 feet and condensing to form a long line of cloud east and west immediately above Wahlenberg Bay. There followed at the head of the bay, a strong north wind, with snow, lasting a day or two.

Cumulus.—Cumulus clouds are reported in particular circumstances during the period of sledging, apart from one instance on July 27, when the northern party was near the west coast. The clouds were then seen to the west, *i.e.* probably not over North-East Land at all. Otherwise cumulus is reported *only* in connection with the great barometric depression, with south-west winds which reached North-East Land on August 1–2.

Intermediate Cloud.—Intermediate cloud was seen in association with the "anticyclonic type" of weather, *i.e.* bright, sunny, and still (rare); or sunny with stiff breeze to blizzard blowing down the slopes of the dome (several days). Surface fog (frequent) associated with the same type of weather naturally prevented any observation.

i. *Alto-stratus.*—The cedar-tree formations which have been described probably pass upwards into the zone of intermediate cloud; they certainly appeared to do so, though accurate measurement was not possible. They were associated with absolutely calm weather.

Quite apart from these, however, were thin alto-stratus clouds, often in small detached and thin lenticular patches, which, with the low altitude of the sun, particularly at midnight, were toned creamy pink (as also the "cedar trees") without heavy outline.

ii. *Cirro-cumulus.*—This type was noted on a number of occasions in fine weather; sunshine gave it the same beautiful colour, and a marbled appearance. In fact, the delicacy, tones, and tints of the intermediate clouds, though impossible adequately to describe or figure, were of exquisite beauty.

iii. *Föhn Cloud.*—On one occasion in particular, during "anticylconic" weather in the calm following the blizzard of August 10–13, prominent "föhn clouds" were seen over Hinlopen Strait from the Base Camp. In relation to the circulation of the atmosphere on the periphery of the ice this is of no little importance: it is possible that the clouds represented the combined downward flow of the upper air above North-East Land and New Friesland, not from the former alone (11).

Upper Cloud.—Cirrus, often of great beauty, was seen on a number of occasions, and, from a few cross-bearings obtained by the two survey parties, sometimes suggested the lateral influx of air at high altitudes to replace the surface downflow (details contained in original manuscript).

Temperature and Wind.

One or two references have already been made to a possible relationship between temperature and wind, but no definite conclusion can be drawn from the available data. Certainly any relationship which may exist is not as marked as others which have been described.

The following points may be noted:

Judging from our experience during the survey of the shores of Wahlenberg Bay, the wind which comes off the ice is definitely cold, and often brings snow: it is not a warm wind such as is experienced in the lower parts of valleys occupied by glaciers (as in Western Spitsbergen). This may be borne out by the poverty of the flora on Oxford Peninsula at the head of the bay.

Of the relations of ice-free sea to winds on North-East Land we know little. It should be noted, however, that though the neighbouring seas may be partially free of ice their surface waters remain at a low temperature. Thus in 1923 the surface water along the north coast was invariably at 33° F.* A great deal of corroborative evidence for the statement is also to be found in the meteorological report of the Swedish Arc of Meridian Survey (10)—for Spitsbergen waters in general. (Allow-

* Information given me by C. S. Elton: for general account of cruise see (1, i.).

ance must be made, in studying the report, for the effect of the Gulf Stream on the west coast of Spitsbergen.)

The air temperature over the sea however is higher—as the record of M/S. *Oiland* shows. Thus in Hinlopen Strait till August 1 the dry-bulb readings oscillated rather regularly between about 42° F. and 38° F., with maximum 48·6° F. and minimum 37·4° F. In Treurenberg Bay, after August 1 the temperatures were rather higher, varying from 53·0° F. to 34·8° F.

During the first blizzard of the central party (July 29 and parts of 28th and 30th) the temperature in Hinlopen Strait was rather higher than usual owing to bright sunshine and absence of cloud.

Although careful analyses have been made by the writer, he has failed to perceive any evidence for the causation of radiating winds in North-East Land by change of temperature in the neighbouring seas; and he is all the more inclined to lay stress on the significance of changes of pressure on the dome itself.

That localized winds are caused by the warming of the larger areas of exposed rock may be inferred from the variable winds experienced at the head of Murchison Bay, where there is a large area of barren land.

Wind Directions. Simultaneous Experiences of Sledging Parties.

Frequent reference has already been made to winds, and many of the more important facts are known to the reader; special reference must now be made to direction and to a few features of importance which have not yet been discussed.

The central party was in a more advantageous position than the northern for studying the effect of the ice dome on wind direction; the course of the former party lay in the interior, that of the latter on the outward journey within a comparatively short distance of the coast of Hinlopen Strait—notorious for the erratic nature of its winds.

Another factor to be reckoned with, especially on the north coast, is ice-pack, the movement of which is well known to have a most marked effect on local winds in its immediate vicinity.

The southern party approached and crossed the interior from the east, and the wind directions recorded are of interest.

For the first day or so after leaving their base both northern and central parties experienced light north winds, then dissimilarity becomes marked. The latter party experienced uniformly northern air currents of varying intensity, and on the surface found wind-etching and sastrugi running across its path from north to south. The northern party on the other hand, recorded variable winds both in direction and speed, showing local influx, on the outward journey (near the coast).

On August 1 the depression to which frequent reference has been made reached North-East Land, and both parties have rather similar

records of calm and south-west wind. All local flow of air was overcome, and the wind continued from the south and south-west, with periods of complete calm, until August 4 (central party) and August 6 (northern party), when the following events occurred :

The northern party was now encamped at " Mount Toil," near Extreme Hook (north coast). F. A. Montague left camp in calm weather to seek on the coast food for the dogs, and there experiencing a very strong southerly wind, made his way back towards camp. Soon after he passed on to the ice and drew within a mile or two of camp he entered a blizzard, which was in progress when he reached camp. While he was on the coast no snow reached him, but at the same time in camp a violent blizzard was blowing and transporting large quantities of snow from the higher parts towards the edge of the ice ; in fact, he had the experience of " walking into " the blizzard, which a little earlier had struck the camp suddenly and unexpectedly. Meanwhile between August 4 and 6 the central party had very variable winds.

On the night of the 7th–8th both the survey parties recorded south to south-west winds, but the southern party recorded mist only and no wind direction, followed the next day by a south-east wind. On the morning of the 8th all three parties made a remarkable discovery of living hover flies and aphids in some numbers, crawling on the ice. These were collected, and have since been shown to have been carried from *the forest belt of Northern Europe—a distance of at least* 800 *miles* (9). That such an invasion of living insects should take place and be proved by three parties widely separated on the high ice terrain of North-East Land is surely an almost unparalleled case of animal dispersal, and is of considerable interest not only to biologists but to meteorologists and to geologists. The discovery also shows the extent to which North-East Land was affected by the great depression.

The last stage in the journeys of the survey parties is of special significance. On the 8th the northern party turned south and the central party west, both making for their base. The former passed over the dome and not round its coastal margin ; the winds it experienced are of particular interest. On the 9th (Camp XII.) well on the flank of the dome, there was a south wind, changing on the 10th to south-west. On the night of the 10th–11th the party was rather farther south when a blizzard set in from the south-west and continued from south-west to west until the 13th, when at midday the wind ceased completely.

Now let us turn to the central party. On the 9th the wind changed at last from south-west suddenly to north ; on the 10th the north wind strengthened, by midday bringing snow and rapidly becoming a violent blizzard, forcing the party to camp (Camp XII.).

From the 10th to the 13th there was a blizzard backing and veering from north to a little west of north, and at midday on the 13th the wind ceased completely. Thereafter there was brilliant weather, with no wind,

and frost; and in the neighbourhood of the coast on August 14 and 15, very strong mirages.

We have then two parties, one on the northern slopes of the dome, the other on the southern, experiencing a violent blizzard from almost opposite directions; in both cases the wind ceased abruptly and completely at the same hour.

Turning now to the southern party, we find a blizzard starting on the morning of the 11th, from the *north-east*, and lasting to *midday* on the 13th. The party was encamped about 5 miles east of the head of Wahlenberg Bay.

We have, then the most interesting fact that this blizzard, recorded from three different parts of North-East Land and from different directions but in each case blowing down the sides of the dome, stopped in all three places at the same time and with most marked abruptness.

This apparent gravitational flow af air, furthermore, started at different times, the central party (Camp XII.) reporting the commencement at 14.00 hours on the 10th, *i.e.* the wind became strong and snow began to be blown at about this time; the northern party (Camp XIII.) during the night of the 10th–11th; southern party on the morning of the 11th (near east end of Wahlenberg Bay).

In this connection it has already been shown that a part of the barometric depression from the south-west probably passed over North-East Land diagonally, from south-west to north-east, and the above times of commencement probably indicate in some measure the rate of its passing and of the removal of its disturbing influence on local gravitational air currents.

Blizzards.

Blizzards of two types were noted: (1) High wind with snow which appears to have been swept from the surface, with *no cloud;* (2) High wind with snowfall from stratus cloud. The second type is an ordinary snowstorm in the first place, but is augmented to an unknown extent by snow torn from the surface. Actual snowfall may cease and the cloud pass away, but the blizzard may continue for hours or days.

An examples of the first type was the blizzard of July 28–29 (central party), when there was a blanket of snow probably not more than about 100 feet thick, at times certainly much less, blown over the surface and collecting more snow as it went, with clear sky above and sunshine. The grain of the snow was very small, to the finest dust; and enormous quantities were also transported along the surface in unending snake-like streams.

Of the second type we had the blizzard of August 10–13, which started as a genuine snowstorm with heavy stratus cloud, but big snowflakes quickly disappeared and were replaced by snow grains and dust. Thereafter it was impossible to tell how much was direct deposition and

Phot. R. A. Frazer

1 *Föhn Clouds (Anticyclonic) from Sledging Base, North-East Land*

Phot. J. R. T. Aldous

2. *Clouds from head of Wahlenberg Bay, associated with high wind and blizzard on the Dome*

Phot. C. S. Elton

3. *Föhn Clouds (Anticyclonic) and Clouds drifting over Mountains, Liefde Bay*

Phot. R. A. Frazer

4. *Anticyclonic Clouds. Camp IX., Central party*

Phot. R. A. Frazer

5. *S.W. Depression Clouds. Camp IX., Central party*

how much transported material, as the blizzard certainly continued long after deposition from cloud had ceased. The conditions on the surface of the ice were the same as in the blizzard already described. By the time the blizzard ceased the surface was reduced to a torn and naked plateau of ice, ribbed with long and narrow sastrugi. The camp formed an island with snow piled high around it and drifts stretching away from it on the leeward side; sledges and their boxes were buried, and the dogs were perched on top of a mound of snow which had accumulated round and over them. During the blizzard the circular entrance to the tent had to be cleared of snow a number of times.

This blizzard in particular was tedious, but the observation of the force and carrying power of the wind was a most impressive study.

If reference is made to Nordenskiöld (8, p. 257), it will be noted that he observed snow blowing along the surface with the slightest breeze. In July and August, 1924, this was not the case, snow-blowing being experienced only with a high wind. The difference is certainly due to temperature. In June 1873 the temperature was uniformly below zero (C.), and the surface of the ice was therefore hard and the snow dry and powdery; in July and August 1924 temperatures above zero were the rule, the surface of the ice was wet and the snow sodden and heavy. Before snow could be transported by wind it had first to be desiccated by frost and by evaporation. Once the surface was reduced to powdery form by evaporation the wind could sweep away the snow, which, by its transport over the surface, acted as an abrasive and so provided more material.

The result was strongly marked wind-etching and fluting, so that a high polish was sometimes imparted to ice and snow surfaces, particularly noticeable on the higher central parts of the dome. Long sastrugi stretched across the country, marking the direction of the wind, while crevasses, stream beds, and other irregularities in the surface were completely obscured.

Snow-blowing began only when the wind was approaching gale strength, and then the finest snow-dust would penetrate almost any defence. The appearance of the surface after a blizzard was in every way analogous to that which the author has since seen in sand-and-clay desert (after continued high wind).

On the coast of Lomme Bay (New Friesland), on the west side of Hinlopen Strait, De Geer has made an interesting observation which may profitably be quoted here in full (2, pp. 35, 36):

"In the small plain situated north-east of the Faxe glaciers, in Lomme Bay, one can see everywhere very clear traces of erosion due to wind orientated in a N.W. direction. It is most particularly on the fine arc-shaped terminal moraine which marks the limit of oscillation of the Faxe glaciers, that fine-grained earth is found swept by wind over the ground in such a way that the stony material has accumulated to form a residual crust of which all the stones

and blocks were strongly corroded by wind, abraded by sand on their faces exposed to the north-west; on which side facets are formed which are limited towards the south-east by sharp sides, while stones have taken the polish which is usual on surfaces over which moving sand has streamed. The grooves polished by wind also showed by their N.W.–S.E. orientation in what direction erosion had taken place. The same phenomenon showed itself in plains where the fine earth was not completely removed by deflation, but in part preserved in countless trails orientated from N.W. to S.E., which had been protected at their end facing the wind by more or less large stones.

The whole phenomenon was a clear proof of the force of falling winds which, in Spitsbergen, come down from the glacial plateaux in the interior of the country where the air condenses by freezing.

For the direction in question the neighbouring glacial plateau is situated to the N.W., but in some places it is not rare to see similar local currents of air come down in very different directions from the glacial plateaux situated in various directions from one and the same fjord. It frequently happens, also, that strong local winds pass through certain valleys or fjords although the atmosphere remains calm on the two sides, and it almost seems that the violent winds which so frequently blow at the northern mouth of Hinlopen ought to rank in the category of these local phenomena." (Semi-literal translation.)

For the last paragraph above, it may be stated that similar phenomena were frequently observed, especially by F. Tymms and C. S. Elton at the Base Camp in Liefde Bay.

I have not observed wind-etched land areas in North-East Land, though they would be well worth looking for in suitable conditions, but De Geer's explanation no doubt accounts for a single wind-etched block of hard limestone which I collected at the sledging base. In this case, however, no direction of orientation was noticed and more than one face had been etched; the block is about 6 × 4 × 4 inches of black oolitic limestone.

C. S. Elton has observed much the same phenomenon in the blasting of vegetation in various places, and I am indebted to him for the following information:

(1) At Deer Bay Island (King's Bay, West Spitsbergen) *Dryas octopetala* grew in waves, with long stems (away from wind) to south-west, prevailing wind from north-east (down a large glacier); (2) the same plant on raised beaches near Bruce City, Klaas Billen Bay (Ice Fjord, West Spitsbergen), grew away from the great Nordenskiöld Glacier in waves; (3) Clumps of the same plant grew on high plateau at Reindeer Peninsula (Liefde Bay) towards south or south-west (*i.e.* where *any* direction was shown); this is of interest because it indicates a cold wind blowing from off the sea to the north (*i.e.* probably from the ice-pack) in spring and summer—the only time when the vegetation is not covered and protected by snow.

Velocity of Blizzards.—This question is almost certain to be raised by the reader, and the answer is comparative only. No wind-gauging instruments were carried by the sledging parties, and accurate estimation

of wind velocity is not easy in the absence of any good indicator such as one uses in temperate and inhabited regions (movement of trees, smoke, etc.). The Beaufort Scale, though used in the ships of the Expedition and at the Base Camp, is difficult of application and its use was not attempted by the sledging parties. To the writer it seems inaccurate except in the hands of highly trained observers of long experience, and then only in reasonable situations, as at sea.

In a small tent the force of the wind tends to be exaggerated owing to the wild flapping and cracking of the silk fabric. The only reasonable criterion seemed to the writer to be the effect of the wind on the observer himself, with experience gained in other situations and climates. The terms used in this paper and to be found in the records of the sledging parties are based on such methods. J. R. T. Aldous gives velocities founded on the same basis.

As far as blizzards were concerned the velocity was agreed by all observers to be distinctly high. In moving about camp while a blizzard was in full blast it was most convenient to crouch low and double the body up. At such a time, while the writer was getting rations of medium-sized ship-biscuits from the food box, two or three were plucked by the wind from his hands (which were protected by gauntlets) and were observed to be carried over his shoulder, and when last seen were disappearing down-wind still maintaining horizontal flight.

The northern party had two of their tent poles, which were very strong, bent, one like a long-bow, by the force of the wind during the last blizzard.

It is not to be imagined, however, that the blizzards in any way approached in severity those experienced by explorers in the Antarctic.

Effect of the Meteorological Conditions.

The writer wishes to make it clear that a complete description of the glaciology of North-East Land is in no way intended in the present paper, the object being solely to put on record the climatic conditions from the point of view of a geologist.

The effect on the surface of thaw and of wind will first be examined. As numerous references to these conditions have, of necessity, been made in the foregoing pages they may here be summarized fairly briefly.

Thaw.

The effect of thaw was disastrous, impossible conditions being met with for the greater part of the distance on the routes followed by the northern and central parties, which were confined to camp sometimes for days, waiting for frost. Much of the last winter's snow still lay on the surface of the solid ice and formed slush with a snow crust quite insufficient to bear the weight of sledges, dogs, or men. There were countless swift streams to be crossed, cut deep into the underlying ice, which were often wide and formed tiresome obstacles. Some-

times areas of snow-morass, with or without streams, were met with. Sledges foundered or overturned at frequent intervals, and men repeatedly sank to the knee, sometimes deeper; dogs were up to their bellies in snow and water, and their feet were usually bleeding. The conditions caused considerable discomfort to men and dogs; nothing could be kept dry, and progress was reduced to an absolute minimum.

These conditions were particularly noticeable in cloudy weather, and the thaw was seen at its height by the central party during the long enforced delay at Camp IX., when the barometric depression passed over North-East Land from the south-west. The effect on the surface may be gauged from a few lines in the writer's diary, dated August 3:

> "In place of the utter silence is a constant roar of rushing water, in surface streams and crevasses; of water falling from surface or englacial streams down crevasses . . .; above this constant roar the boom of snow bridges collapsing and falling into crevasses. Sharp cracks and rendings probably from old crevasses being further opened or new ones formed. In the steeper parts of the ice valley the crevasses are full of water and the surface streaming with it. . . . Our tent, once on a carpet of hard snow about 10 inches thick, now has its floor resting on a plateau of the original height (owing to the protection afforded by the tent) and its poles sunk and merely resting on solid ice. Above, utterly stagnant air, damp and warm, with occasional showers of fine rain.
>
> ". . . Every now and then the note of the roar changes as some channel or crevasse is abandoned or a new one brought into use. . . ."

The "ice valley" referred to above was filled with snow to a depth of some scores of feet; the snow was undermined by lakes and rivers, which dissolved it from below, causing it to collapse and fall into a state of extreme dilapidation.

Large lakes were observed by all three parties, and some of them which were revisited by the central party on its return journey were found to have increased so greatly that in one case a valley which had been crossed on the outward journey was found to be submerged. Sastrugi became soft and hampered sledges, while men sank deep in them—often above the knee and rarely to the waist.

The above state of affairs made marching trying, and called for all the skill of the leader to avoid mishap. The melting also caused minor changes in the surface, such as the in-sinking of mud and dust (in the highland ice) to form cylindrical holes into some of which the arm could be thrust to the elbow.

Enough has now been said to demonstrate the effect of high temperatures on the highland ice, and, to a lesser extent, on the island ice of the more central parts where melting definitely occurred. Surfaces were glazed with ice, water was found running in the small crevasses, and occasionally the snow was soft.

The amount of fresh water poured into the surrounding seas must be enormous; indeed, the surface salinity of Wahlenberg Bay, recorded by M/S. *Oiland* late in July, was virtually ***nil***.

Wind.

Very different was the state of affairs with a clear sky and a high wind, or when the wind approached gale strength. These conditions, when desiccation is at a maximum, have already been sufficiently described. After the blizzard has subsided the surface is perfectly dry and frozen; for the sledger progress in these rare periods is as rapid and easy as at other times it is slow and laborious. Crevasses and other cavities in the ice are filled, which from a geologist's point of view also is important. Personal observations leave uppermost in one's mind two impressions: (1) The enormous quantity of snow transported and the abrasion of the surface; (2) the grand scale on which the countless —and often very big—crevasses of the highland ice are supplied by blizzards with snow, which thus becomes directly englacial.

Though much of the snow is, no doubt, removed by subsequent thaw—as the roaring torrents in crevasses testify—melting due to atmospheric changes is little more than a surface feature, and much of the snow and water is certainly trapped in the deeper parts of the crevasses, to be added permanently to the ice mantle. This impression is left vividly on one's mind from personal observation in North-East Land.

We therefore pass from a consideration of purely surface changes caused by meteorological conditions to a conception of greater importance.

The winds, when not affected from outside the land, form a domestic system of their own: that is to say, they are gravitational, and as such, radial from the higher parts of the island ice towards the lower coastal zone. For the greater part of the year the surface is probably dry, and comparatively slight winds—judging from Nordenskiöld's account—set in motion a flow of snow. In summer personal observation has shown that only winds of high velocity perform this function, but that the system, once started, assumes huge proportions; further, it is seen that these occasional (but by no means rare) summer blizzards carry a vast amount of snow from the high interior outwards. Some of the snow undoubtedly reaches the shore and is lost, but the rest of it stays, and part of it becomes embedded in the cracked and broken highland ice. There is further wastage by melting, but it is the writer's opinion that in all probability there is an augmentation of the highland ice at the expense of the more elevated ice of the interior.

We have then in effect a glacial anticyclone, performing the functions attributed to it in Greenland and Antarctica; actually there is no evidence of rotary movement (it could hardly be expected in so small an area), and there is a tendency to form, but not permanently, a high-pressure area. It cannot be said that a true glacial anticyclone exists; its function however is performed, spasmodically perhaps, but none the less surely.

In conclusion, a few notes should be added. The sledging journeys of 1924 have shown, contrary, it would seem, to Nordenskiöld's belief, that melting takes place in North-East Land, in some years at least, on

an enormous scale, rendering the country almost impassable with lakes, rivers, morasses and other barriers to travel.

If Nordenskiöld found the configuration of the surface to indicate that such melting did not take place, it seems probable that hollows and roughnesses had been completely obliterated by the action of blizzards. In 1924 even the higher parts of the island ice were found to have suffered a certain amount of melting. Thus the northern and central parties found on it usually about 6 inches of snow, and that often "fixed" by ice cementation due to slight melting of the surface. The southern party, on the other hand, found as much as 3 feet 6 inches of snow, waterlogged, on the highest part of the plateau. Earlier in the season Nordenskiöld seems to have met with several feet of unconsolidated snow, even on the highest parts of the dome. On the flatter parts of the highland ice in July 1924 there was a foot or so of unconsolidated snow, and some valleys were completely filled with it to a depth of some scores of feet; by mid-August it had almost entirely disappeared from the upper slopes, removed mostly by melting, partly by blizzards.

In this connection it should be remembered that in winter the surrounding seas are occupied by heavy pack ice, and the air temperature is not necessarily higher than that above North-East Land, as it is when the water is open (or partly open) for a few months in summer. There may then be no such marked tendency towards gravitational flow of air.

In summer the air may raise its own temperature as a result of its gravitational flow, but during a full blizzard a considerable degree of cold is maintained, and the other effect is of no significance.

In the comparatively short period of observation (a month) and owing to the interference of major depressions from outside, it was not possible to establish whether or not blizzards are due to definite pulsations of pressure and are rhythmic, as in Antarctica; such would certainly seem to be the case, but the evidence is not conclusive.

With regard to external interference it is noteworthy that Nansen (6, i.), in the highest parts of North Greenland, found that major disturbances in neighbouring waters had their effect on pressure, *i.e.* they affected the cyclone in the upper atmosphere which supplied the anticyclone immediately overlying the continental ice.

No trace of "cosmic dust" was found; finely divided material was common in the highland ice, especially in the vicinity of crevasses, but microscopic investigation has shown that the material came from underlying rock surfaces.

Duration of the Summer, 1924.

In the interior of North-East Land the summer, at any rate in 1924, seemed to be remarkably short; and it should be remembered that up to mid-June in 1873 Nordenskiöld recorded temperatures below freezing-point and not a trace of melting. We have already obtained some idea

of the enormous scale of melting in July and August 1924, and it may be well briefly to review the state of affairs.

On July 18 it could be seen from the ship off the north-west coast (Low Island) that the high ice of the interior was glistening white, probably indicating that melting was already taking place.

A preliminary reconnaissance was made from the sledging base on July 20, and melting was found to be on a huge scale, and in some directions the country was almost impassable.

The two survey parties had left the shore by July 22, and both found the surface in a hopeless condition. It was then evident that the snow of the previous winter and spring had been neither consolidated nor removed, but lay to a depth sometimes of several feet, soft and waterlogged. But for occasional blizzards and frosts the melting continued through the "anticyclonic" weather and reached an overpowering stage with the arrival of warm winds from the south-west during the first and second weeks of August.

By the second week of August the more exposed surfaces were cleared of snow, and hard rugged ice was everywhere visible. In valley depressions the enormous thickness of snow blown into them by high winds was in a state of the utmost dilapidation.

Thereafter no considerable melting took place. Summer had already passed its height. When R. A. Frazer and the writer visited Mount Idun on August 13, the Arctic poppy was still in full bloom, but most of the extremely scanty vegetation seemed to have reached the end of its summer's growth though the surface of the ground was in the waterlogged condition seen in spring (June) in West Spitsbergen. Stone polygons (rutmarks)—*i.e.* polygons with stone borders—were filled with liquid mud of the consistency of thick soup, and broad streams of mud were making their way down the face of the escarpment.

By this time the sun was getting rather low in the northern sky at midnight, and the surfaces of snow and ice were considerably harder at night. This, combined with the effect of three days' blizzard—which, it should be noted, had removed or hidden nearly all trace of the season's melting over the area it had affected—gave a perfect surface for travelling, and a strong impression that the season had drawn to a close.

Both parties were back to the shore by August 15.

Later, August 24–27, a few visits were paid to the edge of the ice at the head of Wahlenberg Bay (by landings from ship), when it was most noticeable that scarcely a stream existed; a few englacial streams were noted, but the surface was dry and the channels empty. This was most clearly marked on a tongue of ice on the north side of the head of the bay which the writer partly traversed. Here every sign of intense erosion by water was present, but not a drop of water was to be seen.

The sun was now very low at midnight; blizzards continued on the high plateau, accompanied by wind, some snow, and gloomy conditions

in Wahlenberg Bay. The country seemed already to have settled into autumn.

The survival of the ice-foot in places at the head of the bay should be noted; such a thing is unusual in Spitsbergen waters.

Thus in 1924 it seemed that the spring and summer in the bordering belt and interior of North-East Land were accomplished between the early part of July and the third week of August. In this way does the island mark its immunity from the warming effects of the Gulf Stream, and conform rather to the conditions of the high latitude in which it is situated.

Summary.

North-East Land is situated north-east of the main island of Spitsbergen, from which it is separated by Hinlopen Strait, being about 100 miles long from east to west, and 80 from north to south. It is covered by a dome of ice which rises to a little above 2000 feet.

Barometric Pressure.—There is some indication of a lag east and west of Hinlopen Strait during normal conditions; but, in general, between the interior and the neighbouring seas there was close agreement and synchronization of changes of pressure, especially when a major depression from outside swept the area. Minor depressions from outside are probably "cushioned off" by local high pressure over the ice.

Pressure and Wind.—When a major depression from outside the area was absent there was a marked relation of wind to pressure: with a falling barometer, no wind; with a rising barometer, winds, gales, and blizzards blowing outwards from the higher parts of the dome down the slopes as a gravitational flow, these higher parts act as high-pressure areas. At a certain point in the rise of pressure the winds cease abruptly and completely.

Temperature and Humidity.—Temperature was generally at or about freezing-point, but for long periods was slightly above it; the temperature during blizzards is not known, but it was certainly lower. Heavy cloud maintained high temperature, with resulting excessive melting; a clear sky, on the other hand, usually brought frost except during the hours that the sun was southerly, and as the temperature fell fog often formed, but disappeared when frost was established. A depression which invaded the area from the south-west brought heavy cloud and warm winds, which caused melting on an enormous scale. In an interlude between the depression, with a cloudless sky and at first no wind, a shower of lath-shaped crystals of ice was experienced, with a temperature of $-3{\cdot}5^{\circ}$ C.

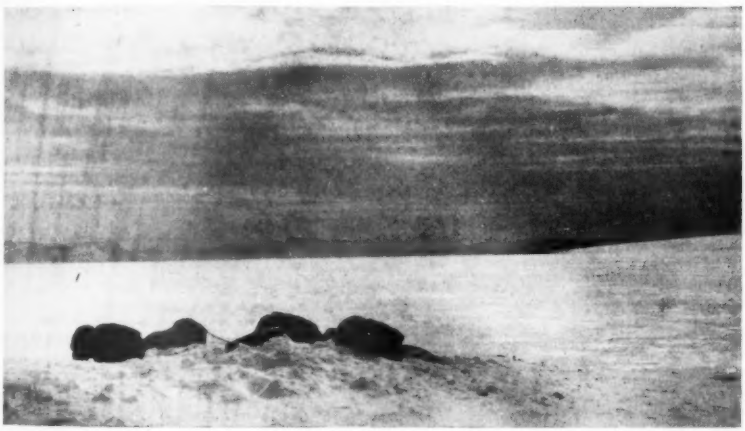
During blizzards the snow was exceedingly fine.

Rain was noted on a number of occasions in the interior as well as near the coast, and at a considerable altitude.

Cloud.—Apart from cumulus brought from the south-west with the

Phot. K. S. Sandford

6. *Sledge and dog team in blizzard. Camp XII., Central party*



Phot. K. S. Sandford

7. *Three days later: Sledge buried; dogs on snow-drift. Camp XII.*

Phot. K. S. Sandford

8. *Dome of Island ice, polished by blizzard and slight thaw*

Phot. R. A. Frazer

9. *Figures on left edge of broad crevasse nearly filled with snow. Camp IX., Central party*

Phot. K. S. Sandford

10. *Snow-filled ice-valley collapsing by surface water melting snow below. Camp IX.*

Phot. J. R. T. Aldous

11. *Water-logged snow on flanks of Dome. Camp II., Northern party*

depression, clouds were of a type associated with anticyclonic conditions. Surface clouds were seen to be blown radially and at high velocity from off the higher parts of the dome. Altostratus, in various forms, and cirro-cumulus were typical, and on occasions well-developed föhn clouds were seen over Hinlopen Strait. Cirrus was noted and appeared to indicate an influx of upper air over the dome.

Temperature and Wind.—There is no evidence that the outward-flowing winds were caused by local changes of temperature, as between land and sea.

Wind.—Appeared to be directly and intimately connected with pressure conditions (as above). The system was upset by the depression from the south-west, which at its lowest point brought numbers of flies to the interior of North-East Land from the forest belt of Northern Europe (at least 800 miles). A prolonged blizzard followed the passing of the depression, with the return of " anticyclonic " conditions ; in three widely separated places of observation the blizzard was experienced from different directions (gravitational in each case), ceasing abruptly and synchronously, after a long rise of barometer.

On the coastal border the winds were more variable.

Effect of Climate.—In the summer of 1924 excessive melting, especially with the south-west winds, removed snow and even ice to an impressive degree ; even the higher parts of the interior were affected, but elsewhere the surface became very dilapidated, and multitudes of old crevasses were also opened up and enlarged.

The outward-flowing blizzards conveyed enormous quantities of snow to the bordering zone of ice, and by depositing it, as well as by direct abrasion, quickly effaced the traces of melting, whilst the higher parts of the interior were torn and strongly abraded.

The summer season appeared to be short.

Conclusions.

A fixed anticyclone does not exist, but, though the oscillations of pressure agree with those of places as far distant as Liefde Bay on the north coast of Spitsbergen, there is a definite tendency towards the establishment of anticyclonic conditions with radial gravitational winds.

There appears to be a type of " intermittent glacial anticyclone," which establishes itself, is blotted out by interference from outside the area, and quickly re-establishes itself again. Winds are most markedly outward-flowing, and lead to a definite augmentation of the bordering ice at the expense of the higher parts of the interior. There is some indication of a pulsation, from calm to blizzard. In summer the effect of this type of " anticyclone " is very marked, and it is a factor of real importance in the control of the supply of the cap of ice.

Melting, which is especially associated with interference from outside is excessive and leads to a depletion of the bordering zone (removing

much of the snow brought from the interior) and, to a less extent, of the higher parts of the interior.

Considering the Arctic Basin as a whole, the essential difference between its meteorological conditions and those of the Antarctic Continent is most strongly marked. The latter we know to support a great glacial anticyclone affecting the whole continent and the neighbouring seas far and wide.

In the Arctic, Greenland, we know, supports a similar system. The Polar Basin does not (so far as I can judge), nor have I any evidence that such conditions exist in the Canadian Arctic or on the Siberian coasts (which are not "glacierized" (5, p. 11)).

The distribution of land and land-ice in Franz Josef Land probably does not lead to a local glacial anticylcone, but in the Spitsbergen archipelago we now have North-East Land supporting its "intermittent glacial anticyclone." In the writer's opinion New Friesland may have a similar but modified system, but in the rest of the archipelago there is, at the moment, evidence only of the usual föhn winds of the glaciers, with a possible tendency to high pressure.

The work done in North-East Land by the sledging parties of 1924 therefore has more than a local value.*

Acknowledgments.

The author is indebted to Professor W. J. Sollas, F.R.S., for his interest and help in the preparation of this paper, and wishes to express his thanks to Mr. H. O. Beckit, as also to Mr. W. G. Kendrew, for reading the original manuscript and for welcome advice and criticism. In the production of the paper in its present form in the *Journal*, the author's thanks are due to Mr. A. R. Hinks, F.R.S., and Mr. L. C. W. Bonacina.

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   ii. See also R. N. RUDMOSE BROWN: 'Spitsbergen,' chap. xxv. pp. 268 *et seq.* Seeley, Service. 1920.
   iii. and F. NANSEN: 'Through Siberia,' pp. 8 *et seq.* Heinemann, London. 1914.
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* While reading the proofs of this paper I have been presented by Prof. W. H. Hobbs with a copy of his Monograph on Glacial Anticyclones (Macmillan, New York, 1926), in which he cites evidence (p. 162) of radial winds in Novaya Zemblya and Ellesmere Land.

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vi. CHAS. WILKES: see W. H. Hobbs: "The Rôle of the Glacial Anticyclone," *Proc. Am. Phil. Soc.*, vol. **54**, 1915, pp. 216–217, and Figs. 8, 9.

vii. C. S. WRIGHT and R. E. PRIESTLEY: *Ibid.*, pp. 8 *et seq.*; and Report of Meteorology, vol. **1** of the same expedition.

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NOTES BY AUTHOR

Note I.

At the moment of going to press there has been published 'Scott's Polar Journey and the Weather,' being the Halley Lecture of 1923 by G. C. Simpson, F.R.S., published by the Oxford University Press, 1926. In this valuable paper I noted the following, in particular, with regard to temperatures during blizzards. It will be remembered that I have stated that during blizzards in North-East Land the temperature was *lower* than at other times, in contrast to the generally accepted views to the contrary. Simpson differentiates the Antarctic blizzards into those of winter and those of summer: during the former there certainly was a most remarkable rise of temperature from the terrible degree of cold otherwise obtaining. Of the latter we read (*loc. cit.*, pp. 16, 17): "During the summer the cold layer cannot form near the ground,

* See note on previous page.

for the sun warms up the ground, which warms up the air. The warm air rises and a cold layer cannot form. . . . There is no surface layer. When the wind blows from the north-west the temperature rises, and when the blizzard from the south sets in just after midday on the 15th the temperature falls rapidly, and during the blizzard the temperature is ten degrees lower than it was during the calm interval before the wind commenced to blow."

The experience of the sledgers in North-East Land thus finds confirmation, although of course the temperature of the Antarctic summer, in calm or in blizzard, is far below any degree of cold we experienced.

Note II.

The foregoing pages were completed nearly a year ago, and have been delayed owing to my absence abroad: at that time a discussion on the Polar Front and allied problems, to which Mr. Bonacina refers, had not come into prominence, and I do not propose at this date to make any alteration in the paper on account of it.

NOTE BY MR. L. C. W. BONACINA:

The evidence given in the paper of a "glacial anticyclone" on a small scale similar in operation to what is observed on a large scale in Greenland and Antarctica is a further exemplification of a type of local circulation that is becoming recognized as a principle in physical geography and climatology. It independently supports, too, and amplifies certain conclusions that had been drawn from observations at the German Observatory in Spitsbergen, 1911 and 1912, to the effect that this, as well as other Arctic archipelagos, commands a local system of high barometric pressure. The outflowing gravitational winds down the flanks of ice domes belong to the class of "katabatic" winds, being substantially of the same type as may be observed in mountain valleys at night or in winter. The relatively high barometric pressure over the ice-domes, however, is only a shallow surface temperature effect, and for this reason the term "anticyclone" should be used with some reservation since glacial anticyclones have little in common with ordinary anti- or contra-cyclones, which are large, deep systems drifting about in the general circulation without any such close relation to local surface conditions. The distinction should be observed with reference to the statement in the author's concluding paragraph that the North Polar Basin supports no anticyclonic system. The fact is, as established by the late Professor H. Mohn from the results of the *Fram* Expedition of 1893–96, that on the average the North Polar Basin *does* support an anticyclonic ridge of relatively high pressure—a "wind-divide"—which nowadays one recognizes as helping to maintain supplies of cold dry air which, drifting southwards, interacts with supplies of warm humid equatorial air to form cyclones along the so-called Polar Front. But this Arctic high-pressure axis, like the Greenland and Antarctic glacial anticyclones, must be a purely superficial temperature effect of the ocean ice-cap; for, as Dr. Harold Jeffreys has lately demonstrated, the poles of the Earth should be the seat of low barometric pressure—and they no doubt would be so in actuality if the surface of the globe were uniform, permitting the planetary circulation to proceed undisturbed by thermal irregularities introduced by ice caps and domes (*Q.J.R. Meteor. Soc.*, January 1926).

Another matter which we think it important to focus attention upon are Mr. Sandford's observations to the effect that in the perpetual daylight of the Arctic summer the temperature tends to drop with clearing sky and contrari-

wise.* If the University of Oxford again sends an expedition to Spitsbergen this subject should be carefully watched, and every effort made to make sure that any accession of cold with sunshine is not due simply to a change in the air supply, or shift of wind to a colder quarter. On the other hand, since a surface of snow is such a rapid radiator of long-wave energy, and since it reflects such a large proportion of the incident solar energy, it may well be that there are certain atmospheric conditions, especially at any altitude where the air is thin, with the sun circling round the heavens at a low angle, when the snow will emit a good deal more heat than it absorbs. If this is really the case the fact is clearly a potential source of spells of cold weather, below the normal temperature, at midsummer in the neighbourhood of the North Pole, such as appear to occur in the Arctic Ocean now and then, otherwise difficult to account for in a basin surrounded by snow-free lands except Greenland. The point is thus of practical importance in forming an estimate as to what degree of summer cold—below the seasonal mean temperature, which is only slightly below freezing-point in July—an expedition to the North Pole would be likely to encounter. And as bearing vitally on this question, it is to be observed that upper-air observations, made on the *Maud* expedition, support theoretical expectation that a temperature inversion, that is a rise with height above the glacial surface, exists at all seasons over the polar sea ; for an inversion would militate against the extent to which cold weather, locally engendered by radiation, could be transported by wind from one part of the polar basin to another, since in that case the air would be warmed by turbulent mixing. Hence another expedition to North-East Land, which appears to be an excellent experimental ground for problems in polar climate, should be well equipped for taking upper-air temperatures.

THE PROBLEM OF THE SHAKSGAM VALLEY

Colonel Sir Francis Younghusband, K.C.S.I., K.C.I.E.

Read at the Meeting of the Society, 8 *February* 1926. *Folding Map follows p.* 288.

THE title of my address this evening is "The Problem of the Shaksgam Valley" ; but probably not a dozen persons here know where Shaksgam is. And little wonder ; for it is a remote uninhabited valley at the back of the Karakoram Himalaya, and has been visited by only two Europeans, and by them thirty-seven years ago. It was discovered by me in 1887 on my journey from Peking to India ; and it was again visited, first by me and then by the Russian (or rather Polish) traveller, Captain Grombchevski, in 1889.† Since then no European traveller,

* The *Fram* results (1893–96) indicate a slight excess of mean daily temperature with clear sky in comparison with overcast sky in July and August, a deficit in May and June, and a very marked deficit in winter.

† The name of this distinguished Polish soldier in Russian service has suffered in successive transliterations. The Polish name, as we are informed by the Secretary of the Polish Legation in London, is GRABCZEWSKI. When turned into Russian it acquired an M before the B, as pronounced, and being thence re-transliterated under a French influence, becomes GROMBTCHEVSKY very commonly in geographical

as far as I know, has actually entered it, though some have looked into it from the Indian side.

When I reached Yarkand, in September 1887 I found a letter from Colonel Mark Bell (the head of the Intelligence Department in India), who had preceded me by a month on the way from Peking to India, recommending me to explore the direct route from Central Asia to India which led by the Mustagh Pass into Baltistan and Kashmir. This route was formerly used by the natives; but nothing was known about it. And it was while exploring this route that I discovered the Shaksgam Valley. I had to cross it on the way to the Mustagh Pass.

I described it briefly in my lecture to this Society in May 1888; and in my lecture to this Society in 1895 I described my second visit to it, when I explored its upper part and its course till the river joined the Yarkand River. But ardent travellers are again seeking to go there, and perhaps some additional observations about it may interest you.

What is chiefly remarkable about Shaksgam is that it is a deep trough running immediately under the wonderful castellation of peaks which group themselves round K_2, the second highest mountain in the world. On the far side of Mount Everest there is a high plateau running up to 16,000 feet, and a well-inhabited plateau. And this is the rule with the other great peaks. On the far side (from India) the country lies at a considerable elevation and the valleys are wide. But immediately under the K_2 group of peaks there is this deep trough running down to only 12,000 feet above sea-level, quite uninhabited and devoid of vegetation except for a few patches of scrub, one of which is called Shaksgam and gives its name to the river which in its lower course is called Oprang by the Kirghiz.

When I left the Yarkand River in 1887 to work my way up to the Mustagh Pass I imagined that I should simply follow up one of its southern tributaries. It had so far been thought that these southern tributaries must all flow straight down from the main watersheds. But on ascending one of them, the Surukwat stream, I found that this was not the case. I found that an intermediate range—the Aghil range—had to be crossed, and that I had to descend into a deep valley, the Shaksgam valley, and then ascend a tributary from *that*—and not a direct tributary from the Yarkand River—in order to reach the Mustagh Pass.

And similarly, when in 1889 I was sent in search of the Shimshal Pass into Hunza, I had to do the same thing. In each case I had to cross the intermediate Aghil Range, dip down into the Shaksgam valley, and then ascend one of its tributaries—in 1887 to the Mustagh Pass, and in 1889 to the Shimshal Pass. It was thus only in a casual way that I discovered this valley. My main object on both occasions was

literature. In the *Journal* we have been accustomed to spell the name GROMBCHEVSKI, by direct transliteration from the Russian spelling, and it will be convenient to retain that spelling, at least for the present.—ED. *G.J.*

military—to explore the passes leading from the north towards India. But in this chance manner I did happen to discover one of the most remarkable regions in the whole Himalaya.

At this distance of time it is possible to gauge the chief impression it left upon me. What was it? No man can enter that region without enduring hardships. Was it these that made the most impression on me? Three weeks ago I had a chill. The doctor was called in. He applied his stethoscope. He issued his orders. I was not to think of getting up; there must be a fire in my bedroom; linseed poultices were to be applied; I was to inhale some infusion; I was to take certain medicines; I was to have hot soups, and so on. And taking advantage of this enforced rest I prepared this lecture. I looked up my old diaries, and in them I found recorded that on a certain day while I was exploring a glacier the ice on a glacier lake broke and I went through up to my waist, and then had to spend the night in my wet clothes sleeping on the floor of the tent, the floor being the glacier itself and the thermometer being nearly down to zero. As I now lay comfortably in bed with a fire near by and read this in my diary a shiver went through me. It was an experience which, I should have thought, I would have remembered all my life. As a matter of fact, I had completely forgotten it. Neither that nor any discomfort I may have had in my 1887 journey, when I slept in the open without any tent right up to and on the other side of the Mustagh Pass, has stuck in my memory.

The impression that *has* remained there and which has sunk deeper and deeper with the years is the impression of the sublimity and grandeur of the region. From the Aghil Range you look down into the deep trough of the Shaksgam River, and then across it to an array of peaks of unequalled mountain majesty. And on both occasions I saw them in dazzling sunshine showing sharp against a sky of purest azure. Here close together were peaks of 25,000, 26,000, 27,000 and in the supreme case 28,278 feet in height, rising above the valley in rugged cliffs and ridges, their summits mantled in glistening ice. It was a glorious sight, and I have often loved to dwell upon it.

And then, when one gets right in among the glaciers under the great peaks to a region where even rock is little seen—where nearly all is snow and ice, sparkling in the radiant sunshine, one has the sense of having reached a higher and a purer world raised far above the murky earth below. And this feeling of exaltation is the supreme impression left upon me by this region—the main impression which has remained with me for a lifetime and which, as experience has proved, has completely obliterated all those minor impressions so marked for the moment, but of such little real depth.

And perhaps contributing to this result were certain lesser causes. First there was the remoteness of this region. It is not particularly difficult to get at, but it is very far away. Enterprising inhabitants of

Chinese Turkestan might get at it fairly easily. But from either Russia or India it is very distant, and flooded rivers make it inaccessible except in the autumn, unless a way into it can be found from near its source.

Besides its remoteness its austerity also helps to produce the impress of exaltation. Not only are there no inhabitants, but there is scarcely a living thing. Here and there is some scrub in the valley bottom. But the flanks of the mountains are sheer rock. Austerity and purity are the characteristics of these mountains. And no one who is not himself at his fittest can win his way into them. They simply hurl from them all who are not fit to be among them.

On the other hand, to those who can stand their austerity and are not afraid to wrestle with them, they give this lifelong joy and exultation.

Such a region must obviously attract geographers. Grombchevski and I have made but a bare reconnaissance of it, and it must be examined more at leisure ; for we had to explore it at a time when we were not only at rivalry with one another, but also when both of us had to beware of attack by raiders from Hunza. And I hope when it is thus explored the result will not be merely a map, but such a description of it as will enable that innumerable multitude who cannot go there to see and enjoy its incomparable beauty. All Grombchevski and I could do was to plod along the valley bottoms and ascend the passes. Future travellers should be able to clamber up the mountain-sides and climb the peaks and tell us of the glories that can be seen from them.

Some of the side valleys and glaciers I explored, but there are others, and especially the glaciers running down from the Gusherbrum Peaks, and K_2, which remain to be explored. And most important of all is the question of the source of the Shaksgam River. I roughly mapped the course of the river from the Urdok Glacier to its junction with the Yarkand River. But I had no time to explore the source : I had to press on to the Shimshal Pass, which was the main objective. I could therefore only conjecture where the source lay, and from what I find recorded in my diary I should suppose it must be at about the point " G " which Major Wood reached in 1914, when in charge of the Survey of India Detachment with the De Filippi Scientific Expedition to Central Asia. For, writing in my diary on 13 September 1889 in my camp on the Urdok Glacier, I say, " The Oprang [Shaksgam] river valley beyond the glacier which I am ascending is again level and open, and has a direction 150°, while at about 15 miles another valley branches off to the east with a direction 120°, and this latter must probably run very nearly up to the Karakoram Pass."

This passage, through an oversight on my part, was not published in my report, and the map-makers had accordingly placed the conjectured source of the Shaksgam River further west than this passage would have justified them in doing. I therefore agree with what Major Wood says on p. 9 of his report, that the valley " H " which he was

looking down from the low pass "G" drains into the Oprang, and "is probably the source of that river."

I should imagine that the valley I was looking up in 1889 was the valley that Wood was looking down in 1914. I was looking up a valley in a direction 120°, that is, a little east of south-east. Wood looked down a valley which extended as far as he could see "north-west to west." If it were not that mountain valleys have a pernicious habit of doing precisely the opposite of what you would expect of them, I should say that it was a foregone conclusion that Wood's valley "H" and my Oprang or Shaksgam valley were the same, and that Wood in 1914 had discovered the source of the Shaksgam—or at any rate one source, for perhaps the other branch mentioned in the passage from my diary may have a greater volume of water.

The whereabouts of a mysterious Saltoro Pass leading into Baltistan was another problem left over from my explorations in 1889. I was only able to satisfy myself—and it was all that was required of me—that there was no pass in that region of any value for military purposes. But the lie of the land between the Gusherbrum Peaks and the Karakoram Pass was exceedingly perplexing, and it was not till Dr. Longstaff discovered the Siachen Glacier and till Dr. and Mrs. Bullock Workman surveyed its upper part that we could be certain that anyhow this pass did not lie as I had supposed at the head of the Urdok Glacier. And I agree with Mr. Hinks' suggestion that the col from which the Workmans looked down into the Urdok Glacier was not the col which I rashly attempted to climb in a snowstorm, but the col of a side valley on the southern side.

The surveys of the Duke of the Abruzzi's Expedition of 1919 also showed that the peak which I had seen from Durbin Jangal was not K_2, as I had supposed. What that very prominent peak is remains then to be determined.

These, then, are some of the problems of the Shaksgam Valley. There is a field here for many years' intensive exploration. The exigencies of military service first brought it to our knowledge. The trained surveyer, the artist, and the climber can now take up the work.

But before concluding I would say a word about my rival but friend, Captain Grombchevski. After I had finished my exploration of the Shaksgam Valley and had discovered the Shimshal Pass I met him in another valley, a small tributary of the Yarkand River, on his way to Shaksgam. That meeting I have already described in 'The Heart of a Continent.' I also met him in 1890 in Yarkand, on my third journey—this time to the Pamirs. On both occasions he showed me the warmest cordiality. But I did not hear of him again—except that he was holding important posts in Manchuria—till last year, when he sent me a book he had written in Polish describing his journey, and from the Polish Legation I heard that he had had the saddest ending to a dis-

tinguished career. He had risen to high position in the Russian service, but in the revolution had been thrown into prison and robbed of all his goods. Through the assistance of the Japanese he had been able to get back to Warsaw. But he was completely broken down [and has since died]. I was at least able to assure him of the admiration we British had for him. For besides this journey to Shaksgam in 1889 he had made a much more important and daring journey to Hunza in 1888, to counteract the effects of which Colonel Durand was sent there from Gilgit in 1889, while I was sent to explore the passes into it from the north.

I would close my lecture with a tribute of admiration for the enterprise of this distinguished Pole.

Before the paper the PRESIDENT (Dr. D. G. HOGARTH) said: It would be not only superfluous but, I think, rather impertinent for me to attempt to introduce to you the lecturer this evening. Sir Francis Younghusband's name is written across the whole history of Himalayan exploration for the last forty years. He is almost, if not quite, the *doyen* of all Himalayan explorers in this country. You will find his name, for example, up and down the encyclopædic works which a President of this Society, the late Lord Curzon, wrote about Asia. In the course of those explorations a very long time ago—in the year 1889—Sir Francis Younghusband, then Captain Younghusband, found himself in what we now call the Shaksgam Valley. Since 1889 neither he nor anybody else has been in that valley. The country to the south of it has been explored by more than one party. A list has been given to me of those who have actually been in the south: Sir Martin Conway, who is here to-night; Dr. Longstaff, who is also present; the Duke of the Abruzzi; Dr. Hunter and Mrs. Bullock Workman. From the east it was seen by the expedition of Dr. De Filippi (I suppose in an English audience he ought to be given the full benefit of his K.C.I.E. and called Sir Filippo De Filippi), and Colonel Wood in 1913. But the actual Shaksgam Valley has not been visited again. It is about that that Sir Francis is going to speak to-night. I believe that what he saw in 1889 has been recorded, but practically shut away from the public ever since in official reports. I hope Sir Francis will be able to communicate some part of that to us in the course of the evening. He has very kindly undertaken to state the problems which still remain for solution in this very interesting country. There are a great many problems there of purely geographical interest; no political question is involved. But this particular region is beginning to attract attention as a part of the Himalayas which ought to be better known, and in which it is desirable that exploration should at some time be undertaken. I will now call upon Sir Francis to speak.

Sir Francis Younghusband then read the paper printed above, and a discussion followed.

General Sir EDMUND BARROW: I have been asked by the Chairman to give you some idea of the explorations with which I was fortunate enough to be associated in 1886, two or three years before Captain Grombchevski visited Hunza. My acquaintance with that region is limited to the adventurous journey of the Hindu Kush Commission from Gilgit through Hunza to Wakhan in the spring of that year. Our chief difficulties on the road were not its natural obstacles, but those we encountered in the person of Ghazan Khan, then Mir

of Hunza. I do not think I ever met a greater ruffian than Ghazan Khan. He not only used every means short of force to obstruct our passage, such as preventing supplies reaching us, but threatened our liberty unless we handed over to him a fort called Chaprot, which of course we had no authority to do, Chaprot being in recognized Kashmir territory.

We were almost the first Europeans to travel right through his country, and when we reached Hunza—his capital and residence—we received a most inhospitable welcome from him. In fact, we were virtually his prisoners. He told us there were only three courses open to us: either to deliver Chaprot, or to go back to Gilgit, or to try to go on without his assistance. We naturally refused these alternatives, and insisted that he had got to help us, or at least to feed us. This annoyed him greatly, and he even considered whether it would not be simpler to kill us and report our death by avalanche. Eventually he let us go on, but gave us little help or supplies. However, by bribing his officials and buying direct from the villagers *en route* we successfully managed to make our way across the Hindu Kush by the Kilik Pass, which, though a snow pass over 15,000 feet, is not really difficult if crossed before sunrise while the snow is still fairly hard.

On the whole the Hunza route is not one to be recommended to ordinary tourists, but most young and active Englishmen feel an immense attraction to countries or places which have been little visited, and there is no greater satisfaction than that which they experience in the successful accomplishment of such explorations. I at least always look back on my visit to Hunza and Kanjut with the most lively pleasure.

Dr. T. G. LONGSTAFF: It has been a very great pleasure to me to hear Sir Francis Younghusband and Sir Edmund Barrow speaking of Hunza and of the Kanjuti raiders; the result of these first visits and of subsequent contact with other British officers has been to turn those raiders into some of the best frontier militia we have. I think the most interesting of all my visits to the Himalaya was that which fell to my lot, when I was being paid to do what I formerly had to pay to do, while I was serving with those same raiders of Hunza and Nagar in the Gilgit Frontier Militia during 1916 and 1917.

Sir Francis Younghusband has raised a very intriguing problem in connection with the Shaksgam, and there are one or two points that I think should be put on record at such a meeting as this, which is a sort of official *résumé* of our knowledge of that particular bit of country, and to which I feel that he has not quite done full justice—needless to say, to himself!

Sir Francis is the only European who has been in the upper part of the Shaksgam Valley, but the problem of the Saltoro Pass is by no means a new one. There is an obscure reference to it in the 'Tarikh-i-Rashidi' of Mirza Muhammad Haidar, written in the sixteenth century, and I think there is also a reference to it by Mir Izzet Ullah. Those references however are not illuminating, and it is to that accomplished and rather neglected traveller, G. T. Vigne, that we owe our first definite information. In 1835 he approached the problem from the south side, while in 1889 Sir Francis attacked it from the north. You will see from the old Survey of India map that before Sir Francis went to that region the country to the north of the Karakoram range was unsurveyed—it is just left as a white blank space; and the main axis of the range is projected southwards in a great angular bastion which projects down to below Vigne's Saltoro Pass at the head of the Bilafond glacier. When Sir Francis' work came to be plotted it was brought down to fill up that great blank wedge beyond the (hypothetical) water-parting. But in 1909, before

I started off to follow Vigne's footsteps, I spent a most delightful week with Sir Francis in the Residency at Srinagar, when he was kind enough to get out his maps and notebooks of 1889 and go through them with me. According to his route-book it was impossible to be certain of the longitudes, for these depended on the correctness of his identification of K_2 from the north, but as regards his latitudes there was no earthly reason for doubt, and yet on the official map his route had been stretched far down to the south of his observed position to fill up that awkward gap. Now I want to show you a slide: Sir Francis will no doubt recognize his own handwriting. You will see on the sketch the dotted line which represents the outline of the main axis of the Karakoram as laid down on the Indian Atlas sheet. Sir Francis drew this on the day when we had really come to grips with the problem, finally saying in effect, "I was right and it is the map which is wrong; the main axis of the Karakoram is not that shown on the maps, it is here." The man who had been there himself was right: if his original notes and maps had been accepted the mistake that was made of extending the Karakoram axis so far to the south would never have been made, and I should never have had the credit for the little discovery I made in 1909.

Following up Vigne's route, with the late Arthur Neve of Srinagar and with Captain Morris Slingsby of the Frontier Force, who so gallantly laid down his life in 1916, we crossed the pass at the head of the Saltoro Valley, which Vigne had been to the foot of, now called the Bilafond La, and saw the remains of stone shelters used by former native travellers on this route; after another day's march we got out on the north side on to a great glacier which nobody knew anything about. The lower part of that glacier was not unknown, for Colonel Henry Strachey ascended its foot in 1848, but no one imagined that it was 45 miles in length. We followed it up just far enough to see the end of it, and at its head saw a gap in the ridge, which I called "Younghusband's Saddle" on my sketch-map because it corresponded in latitude with his observed position. In Khapalu Rajah Shir Ali Khan had told me that there were two routes through the Saltoro Valley, one to Yarkand and one to Nubra: the same tale was told to Vigne in 1835. The finding by the Workmans in 1912 of an old bivouac farther on beside the main Siachen glacier convinces me that the tradition is correct, and that the main range was formerly crossed just about here. I want you to appreciate the accuracy of Sir Francis' original work and to realize that our chief discovery in 1909 was that the water-parting was just where he said it was! There on his sketch is K_2; here is Broad Peak and the Gusherbrums; here is the latitude of the Urdok glacier; then the axis runs east through Teram Kangri and on into the Rimu peaks explored by Sir F. De Filippi in 1914, and thus on nearly due east to the Karakoram Pass, all just as the lecturer predicted. There is one omission: for though the Aghil range, which he alone has crossed, is correctly shown articulating with the Karakoram axis on the north, yet at the actual junction there is an easy pass, which you saw in the last photograph which Sir Francis exhibited. This is the pass discovered by Major Wood* and Mr. Spranger, which you will realize is really beyond and to the north of the main Karakoram range, and which must lead directly to the headwaters of the Shaksgam River, into

* May I here record my belief that Major Wood is quite correct ('Survey of India Report on the De Filippi Expedition, 1914' (Dehra Dun, 1922), p. 5) in concluding that the plate opposite p. 640 of my paper in the *Geographical Journal* for June 1910 is *not* Teram Kangri but De Filippi's 7391–7388-metre group at the head of the southern branch of the Rimu glacier.—T. G. L.

which the Urdok glacier drains. Incidentally Major Wood found another pass over the tail of the Aghil range a few miles farther to the north-west, with traces of recent travellers. As yet we do not know exactly where these trails crossed the main range: but soon the riddle will be solved, and when it is, then I am willing to bet that the rough sketch which Sir Francis Younghusband drew on a bit of paper in the Residency at Srinagar in 1909 will correspond very well with the reality as revealed by the most modern theodolite in 1926.

The PRESIDENT: The hour is late. I do not know whether Sir Francis would like to say anything in reply to what has been said. You will agree with me that he, Sir Edmund Barrow, and Dr. Longstaff have succeeded in showing that there is still a very considerable deal to do in the Shaksgam country. There lies a problem of extraordinary perplexity and interest which awaits any future explorer fortunate enough to be able to get into that particular part of the Himalaya. You will, I am sure, join with me in giving cordial thanks not only to Sir Francis Younghusband (though chiefly to him) but also to those who have followed him.

NOTE BY THE SECRETARY ON THE POSITION OF THE URDOK GLACIER

Some years ago Sir Francis Younghusband presented to the Society his original field book containing all his astronomical observations made on the journey in 1889 when he crossed the Aghil Pass into the Shaksgam Valley and ascended the Urdok glacier, but was unable to reach the col at its head. His observations include pairs for latitude by north and south stars, altitudes for local time, and an observation for azimuth on a peak which he took to be K_2. His orderly kept a compass traverse. All these observations were turned over to the Survey of India at Dehra Dun, and were worked up by a computer in the Survey.

When the Duke of the Abruzzi was preparing his expedition to the Karakorum the Survey of India plotted for him a diagram showing the route of Sir Francis in the Shaksgam as deduced from his observations, placed with reference to the outline copied from the map of Dr. J. Jacot Guillarmod in 'Six mois dans l'Himalaya.' The following are the latitudes and heights from the observations of Sir Francis:

Kulan Jilga	Lat. 36° 7′ 22″,	Height	—
Durbin Jangal	,, 36° 2′ 0″	,,	12329 feet.
Gusherbrum Jilga	,, 35° 56′ 5″	,,	12962 ,,
Urdok glacier, Camp II. ..	,, 35° 48′ 5″	,,	13880 ,,
,, ,, III. ..	,, 35° 45′ 45″	,,	14144 ,,
,, ,, IV. ..	,, 35° 41′ 20″	,,	15355 ,,

The computer at Dehra Dun seems to have concluded that nothing could be made of the observations for azimuth and longitude.

The Duke of the Abruzzi's mapping showed that the Guillarmod map was seriously wrong in the position of Staircase Peak in relation to K_2: it was placed too far east: and this affected the plotted position of the Shaksgam–Urdok route in longitude. But the latitudes seemed entitled to every confidence: they showed that the col above the head of the Urdok glacier must be close to latitude 35° 40′.

When therefore Mrs. Bullock Workman's surveyor Mr. Peterkin deter-

mined the latitude of what she called the Turkestan La as 35° 40′, she wrote a passage which has often been taken to mean that she believed the Turkestan La was the head of the Urdok glacier. I was under this impression myself when I remarked to Sir Francis about the time of the Meeting reported above, that it seemed clear from the Workman photographs that the glacier they looked down from the Turkestan La was not the main Urdok but a western affluent.

A recent re-reading of Mrs. Bullock Workman's passage seems to me to show that we had misinterpreted it. The passage is as follows:

"The col we stood on forms a semicircle and ends in the bergschrund-festooned wall visible in the foreground. Directly below the col a sharp drop occurs, say of 2000 feet (it is difficult to estimate height from above a wall). Below, this wall shades off into a short crevassed glacier, which, as an affluent, joins a wide trunk-glacier flowing north-west towards its tongue. We saw well only the upper part rising south-east towards its source behind the group of peaks above mentioned. From the edge of the col the end of the triangular mountain-mass discovered from the Indira col was seen, and the main glacier appeared to take its downward direction along the base of these mountains.

"It is probable that this large glacier flowing north-west joins the Gusherbrum stream seen from the Indira col beyond the triangular mountain-range, or that both end in the same valley near together. The latitude, 35° 41′ 20″, of the point reached by Sir Francis Younghusband on the Urdok glacier would about correspond to that of this col. After consultation with him there appears to be but one conclusion possible—that this is the glacier he ascended in 1889 when in search of the Saltoro pass, and named the Urdok. The col he saw culminating the Urdok is probably a ridge of the mountain-group seen by us from the east Siachen col [Turkestan La]."*

The ambiguous words are in the middle of the second paragraph: ". . . that of this col." The reference cannot be to the Indira: it has been taken as to the Turkestan La: the last sentence makes it probable that "this col" does not refer to either of the cols visited by Mrs. Bullock Workman; and that her interpretation of the photographs was really the same as ours, but that she had obscured the argument by quoting the latitudes unnecessarily.

Some months ago, with the permission of Sir Francis, I tried to see if I could deduce anything from his observations for longitude, which had been rejected by the Survey of India; and as a preliminary I re-computed the latitudes, mostly meridian altitudes of Altair south, and extra-meridian altitudes of Polaris north. The latter required of course the sidereal time, to be derived from the altitudes of the Sun, and a deduced rate for the one watch which had survived to that date. At Shahidulla Sir Francis had recorded that the index error of his sextant was zero. It soon became apparent that in the Shaksgam it was about 3′. There was a discordance of 5′ or 6′ between the latitudes from north and south stars, pretty constant; and the means of the pairs agreed within a few seconds with those derived by the Survey of India. The agreement was as close as could be expected, considering the uncertainty of the sidereal time.

A recomputation of the local times with the deduced index-error did little,

* *Two Summers in the Ice-wilds of Eastern Karakoram*, by Fanny Bullock Workman, pp. 186 *et seq.*

however, to improve the concluded rates of the watch; the Sun-observations for time were all in the morning; the index-error was uncertain; and I was compelled to agree with the computer of the Survey of India, that no differences of longitude could be deduced with any advantage. But the observations for latitude seem unassailable, and it will be surprising if they are not confirmed some day by precise survey.

The Survey of India plotting shows the snout of the Urdok glacier a little away from the Shaksgam river, as described by Sir Francis. But it makes the route up the glacier run south-westerly to Camp II., thence a little south of south-easterly to Camp IV., and thence south. The authority for this curve in the glacier must be the compass-traverse of the orderly, which cannot now be found in the records of the Survey of India or in the Intelligence Department. The triangulation chart compiled by the Survey of India in 1922 gives a different outline of the glacier, which is evidently influenced by the misinterpretation of the Bullock-Workman narrative mentioned above.

A. R. H.

'AIDHAB

G. W. Murray, Survey of Egypt

THE hackneyed comparison of desert life with seafaring still holds good—long periods of monotony are broken by events as surprising as a shipwreck or a fire at sea. Last December on the Red Sea coast of the Sudan, I came across the jetsam of a great catastrophe of this sort. On a flat and waterless mound, in wet weather almost an island, separated by 10 miles of flat desert from the majestic wooded peaks of Jebel Erba, lie the ruins of 'Aidhab, a mediæval city of some importance.

It is perhaps mentioned by the tenth-century geographer, Ibn Haukal,* who says that the produce of the gold-mines in the Wadi 'Alaqi was carried to a certain castle on the sea-coast called "Assab," or "Assat." (The reading is corrupt.)

Certainly during the period of the Crusades the land route to Mecca through Sinai and Northern Arabia became unsafe for pilgrims from Spain and North Africa, and they preferred to ascend the Nile as far as Sus or Aswan, from both of which places roads could be followed through the desert to 'Aidhab, a port on the African coast of the Red Sea opposite Jidda. Makrīzi indeed says † that for 215 years from A.H. 450 (A.D. 1058) the Mecca caravans followed this route, and that "it counted formerly among the most important ports of the world, because the ships of India and Yemen disembarked their merchandise there."

The Mecca pilgrims were not, however, safe even at 'Aidhab, for in 1182 Renaud de Chatillon, amongst other piratical exploits, sacked the town, massacred an entire caravan, and destroyed sixteen ships

* Ouseley's translation, p. 13.
† Ed. Bouriant, pp. 588–9.

here.* For this and other interference with the pilgrim traffic, Renaud, the lord of Kerak, alone among the Crusaders, was not granted quarter by Saladin after the battle of Hattin five years later.

'Aidhab was visited by Ibn Gubayr † in 1287, who gives the following itinerary:

Mon.,	June	6th.	Left El Mabraz near the castle of Qus about the hour of evening prayer.
Tues.,	,,	7th.	Reached El Hagir. Eclipse of the Sun.
Wed.,	,,	8th.	Passed Qila el Diya at noon. Reached Laqeita.
Thurs.,	,,	9th.	Took the road Gariatein in the morning.
Sun.,	,,	12th.	Reached Dunqash at night.
Wed.,	,,	15th.	Reached Shaghib after sunrise.
Sun.,	,,	19th.	Reached Amtan after sunrise.
Tues.,	,,	21st.	Arrived at Mugag at noon in the road of El Wadah. (This was the Aswan–'Aidhab road, which here joined the Qus–'Aidhab route.)
Thurs.,	,,	23rd.	Night reached the end of El Wadah.
Sat.,	,,	25th.	Left El 'Ushra by night.
Sun.,	,,	26th.	Passed the spring of El Hubaib early: arrived at 'Aidhab in the evening.

Of these places Laqeita and Dunqash are known and appear on the recent 1 : 500,000 maps of the Survey of Egypt. Amtan may be the present Bir Betan, while Mugag is almost certainly Wadi Abu Murgag, a small tributary of Wadi Rahaba. El Wadah is still a name for the whole coastal plain between the Wadis Rahaba and Kiraf. El 'Ushra means "the *Calotropis* trees," and there used to be some in the plain, near the point where Wadi Dii-t loses itself therein about 20 miles from 'Aidhab.

Forty years later Ibn Batuta, in 1326, started from near Edfu on the Nile, in the company of Arabs of the tribe Dughaim. He says, "Our course was through the desert, in which there were no buildings, for a distance of 15 days. One of the stages at which we halted was Homaitira, the place in which the grave of El Wali Abul Hasan el Shadli is situated. After this we came to the city of 'Aidhab, the inhabitants of which are the Bega, who are blacks. Among these people the daughter never succeeds to the property. At this time two-thirds of the revenue of 'Aidhab went to the king of the Bega, the remaining third to the king of Egypt." He found himself unable to proceed farther on the pilgrimage by this route, and returned to Qus.

After the fall of the Latin kingdom of Jerusalem, the Mecca caravans from the West returned gradually to the route through Sinai, and the traffic through 'Aidhab became restricted to pilgrims from the Sudan. Abul Fida ‡ says, "'Aidhab is a town in the land of Bega . . . it is politically dependent on Egypt, . . . though some say it is in Abyssinia.

* G. Schlumberger, 'Renaud de Chatillon, prince d'Antioche,' etc. (Paris, 1898), pp. 266–7.

† Trans. Schiaparelli (Rome, 1906), pp. 36–45.

‡ Reinaud's trans. (Paris, 1848).

'Aidhab is the rendezvous for the merchants of Yemen, and the pilgrims who, leaving Egypt, prefer the sea-route and embark for Jidda. . . . In other respects 'Aidhab has more the aspect of a village than a town."

Idrisi says, " At the extremity of the desert and on the borders of the salt sea is 'Aidhab, from which one crosses to Jidda in one day and one night. 'Aidhab has two governors, one appointed by the chief of the Bega, and the other by the princes of Egypt."

Although gradually deserted by the pilgrim traffic, trade with the Far East must have gone on right down to the final destruction of the city, for some of the sherds of celadon and blue-and-white China porcelain on the site are definitely Ming in date, that is, later than 1368. The town is shown on the maps of Dalorto 1325, an anonymous Catalan 1375, and Freducci 1497. Ribero 1529 gives nothing between Suakin and Qoseir. Later maps give Zibid, perhaps a draughtsman's error. It was however known as Zibid, not 'Aidhab, to Leo Africanus, who, writing in 1529, gives an account, truly African in its horror, of the end of the ill-fated city.* Speaking of the kingdom of Nubia, he says :

" They had once a rich towne situate upon the red sea called Zibid, whereunto belonged a commodious haven, being opposite unto the haven of Zidem (Jidda) which is fortie miles distant from Mecca. But a hundred yeeres since it was destroyed by the Soldan, because the inhabitants received certaine wares which should have been carried to Mecca, and at the same time the famous port of Zibid was destroied, from whence notwithstanding was gathered a great yeerely tribute. The inhabitants being chased from thence fledde unto Dangala (Mersa Dongola or Dungunab) and Suachin, and at length being overcome in battaile by the governor of Suachin, there were in one day slaine of them above fower thousand, and a thousand were carried captive unto Suachin, who were massacred by the women and children of the citie."

The editor, Dr. R. Brown, quoting Ramusio,† says this took place in 1426 under the Circassian Mameluke Sultan, El Ashraf Bars-Bey (1422–38).

The inhabitants of Suakin, colonists from Hadramaut, were no doubt only too glad to help in the destruction of their rival in trade.

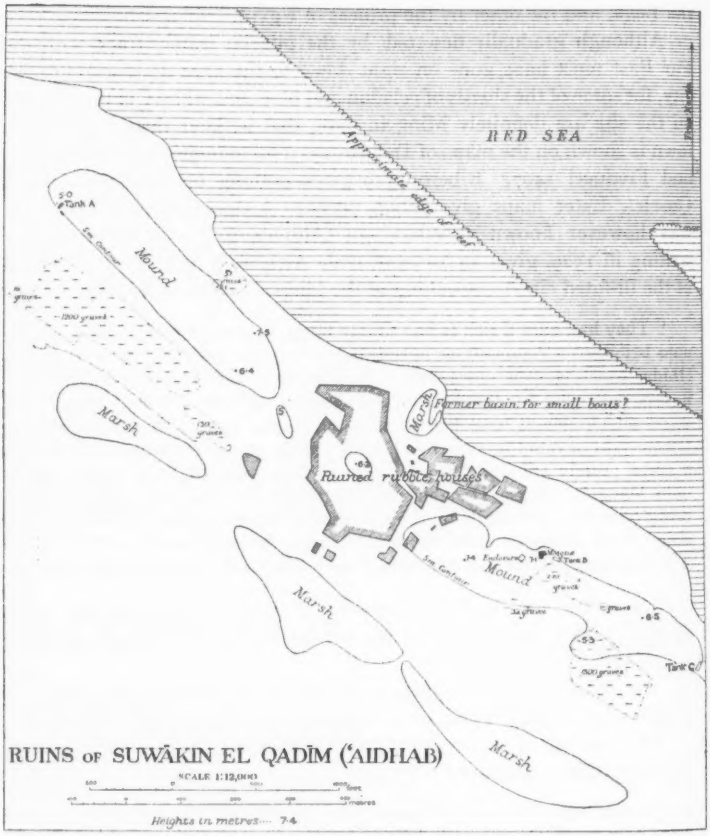
The site was discovered and briefly described by the late Theodore Bent in 1896.‡ He says :

" From here (Halaib) we made two expeditions. The first was to the ruins now known as Sawakin Kadim, on the coast 12 miles north of Halaib. It is like Berenice, nothing but a mass of mounds, and must at some time or other have been a much larger place. We excavated one of these mounds, but found nothing earlier than Kufic remains, unless the graves, which were constructed of four large blocks of madrepore sunk deep into the ground, may be looked upon as a more ancient form of sepulture. We opened several, but unfortunately they contained nothing but bones. Originally this town must

* Leo Africanus, 7, Hakluyt Soc. edition, vol. 3, p. 837.
† Ed. 1630, p. 806.
‡ *R.G.S. Journal*, 8, p. 336.

have been built on an island, or an artificial mound must have been dug round it to protect it on the mainland side ; this is now silted up, but is traceable all along."

[This low-lying ground is shown on the map. There seems no reason to suppose it artificially dug, or that the site was an island in historic



times. At the time of my visit it was flooded with a few inches of rain-water.—G. W. M.]

Bent goes on : " Three large cisterns for water are still in a fair state of preservation, and I am told a Kufic inscription was found here some years ago. There seems to me to be no doubt that this town is the one mentioned by the Arab geographers Aboulfida and Edrisi, by the name of Aydab."

So far as I am aware no other European than myself has been to 'Aidhab since Bent's visit.

Why this site was chosen for the town in preference to Halaib, the Chersonese of Ptolemy, only 12 miles to the south, is entirely obscure. Halaib has a better anchorage and plentiful brackish water. 'Aidhab must always have been an inconvenient port of call, the anchorage is small and exposed, and there is no fresh water nearer than the springs in Jebel Erba, the *Prionotus Mons* of Ptolemy, 10 miles away. A salt well, Bir Abu Ramad, exists 3 miles to the north at the mouth of the Wadi 'Adheib, whose name still preserves that of the city in a diminutive form.

The ruins are all of rubble, there being no good building-stone near, and the houses were very small. They were no doubt roofed with matting like those of the present-day Qoseir. The remains of a prominent building were found, by a little excavation which exposed the *qibla*, to be a mosque.

I found the latitude and longitude of a cairn built in the remains of this mosque to be (by triangulation based on that of the Nile Valley) 22° 19′ 47″ N. lat., and 36° 9′ 32″ E. long.

The three tanks mentioned by Bent were found and measured. Their dimensions were :

Northern	..	..	16 m. long × 3·5 wide × 2 deep.
Central	..	..	17 m. ,, × 2·5 ,, × 2·6 ,,
Southern	..	..	17 m. ,, × 4 ,, × (?)

That is, if brimful, they would hold about 25,000 gallons each. The northern was almost full of rain-water when we arrived, but it all leaked away in 48 hours. The other two are in very poor repair.

Some Arab copper coins were found, only one of which could be identified as struck by Sultan Baibars, 1260–1277 A.D. There were many glass bangles, all broken, and my camel-men tried these relics of the fair ladies of 'Aidhab on their brawny arms with great amusement. Many fragments of Chinese porcelain and celadon ware of the twelfth to fifteenth centuries showed a former trade with the Far East. I have not observed these elsewhere on the Egyptian coast, though "pseudo-celadon"—that is, imitations made locally—were seen at Old Qoseir and here. Curiously enough the fishers at Halaib still collect sea-slugs, which are shipped *via* Suakin to China, so that the connection between China and this coast survives. Within human memory a junk has been into the Red Sea to collect them.

The most striking feature of the site, and a rather depressing one, is the disproportionately large size of the cemeteries as compared with the smallness of the town, which probably never held more than 1500 inhabitants. The unhealthy nature of the pilgrim traffic had no doubt a good deal to do with this. About 3000 graves were counted, all Moslem,

and many enclosed, as Bent says, by four large rectangular slabs of coral set on end.

The Bisharim of Jebel Erba call the site Sawākīn el Qadīm, and the tradition lingers among them that the " Dawla " (Government) formerly existed there.

An occasional fisher may cast a net there now, but the only inhabitants seen were the ubiquitous land-crabs.

I am indebted to Mr. E. Heawood, the Society's librarian, for calling my attention to the important passage in Leo Africanus, describing the fall of the city.

THE ECONOMIC DEVELOPMENT OF TROPICAL AFRICA AND ITS EFFECT ON THE NATIVE POPULATION

The Hon. W. Ormsby-Gore, M.P.

President's Address to Section E (Geography), British Association, Oxford, 1926.

FOUR MILLION square miles of Africa lie within the British Empire. In fact, there is more of the British Empire in Africa than in any other Continent. British North America and Australasia are both smaller in area than the African possessions of the Crown. Approximately three-quarters of this African area lie within the Tropics, and it is only outside the Tropics in the Union of South Africa and Southern Rhodesia that European colonization has yet succeeded in establishing the European race in any considerable numbers.

I define Tropical Africa as that part of Africa which lies south of the Great Sahara and north of the Zambezi River. As far as the British Empire is concerned this area comprises three main blocks of territory. First the East African group, consisting of British Somaliland, Kenya Colony, Uganda, Tanganyika Territory, Zanzibar, Nyasaland, and Northern Rhodesia. This block contains a population of approximately 12,500,000 Africans, 50,000 Asiatics, and less than 20,000 Europeans.

The second block, almost equal in area to the East African group, but with less than half the population, is formed by the Anglo-Egyptian Sudan.

In West Africa we have four colonies with a total area of half a million square miles and a population of over 24,000,000 Africans. In British West Africa there are no permanent European settlers or colonists, and owing to climatic reasons the European is only a temporary resident, usually for quite brief spells at a time. A small exception is found in the German plantations on Cameroons Mountain.

The greater part of these vast territories has only been brought under the guidance of British administration within the last forty years; consequently the problems of economic development as well as of policy and administration are comparatively new. We are beginning to realize, however, that this new African Empire is one of enormous potentialities and great natural riches. These riches are in the main agricultural, as the mineral deposits so far discovered are comparatively few. History shows that the discovery of valuable

minerals is one of the most fruitful causes of the rapid opening up of new country. There are copper, zinc, and lead in Northern Rhodesia ; tin and coal in Nigeria ; gold and manganese in the Gold Coast ; but so far, at any rate, the value of these products is comparatively small when compared with the value of the products of the soil and forests. For example, more than four-fifths of the exports of the Gold Coast are cocoa, and more than nine-tenths of those of Uganda are cotton.

The leading products of Nigeria and Sierra Leone are those of the oil palm ; those of Kenya and Tanganyika, sisal hemp and coffee. The principal export of Nyasaland is tobacco ; of Uganda and the Sudan, cotton ; and of the Gambia, ground-nuts.

This brief review shows us we are considering countries to which the temperate world is looking to-day, and is bound to look more and more in the future, as the source of those raw materials and foodstuffs which cannot be grown in the temperate zones. They are thus of peculiar importance to Britain as a manufacturing country, but also to the whole civilized world inhabited by persons of European race.

Conversely, the absence of iron and coal, as well as the character of the population, seems to point to Tropical Africa as an area of the world where manufacturing industry is not likely to develop. Consequently Tropical Africa is a natural new market for the manufactured goods of the temperate zones, and between Tropical Africa and the countries inhabited by Europeans there is a natural complementary trade between raw materials and foodstuffs of the one and manufactured goods of the other.

Thus we see that the development of the economic resources of Tropical Africa is one of our duties as well as one of our rights. We undertake the task from no selfish motive, but from the dual point of view of helping the indigenous populations to advance in the scale of civilization and of furnishing the world with an increased supply of products which it urgently requires.

The task is complicated by two main factors : the first climate, and the second the wide differences in traditions and capacities between the ruling race and the native population.

As regards climate, we have to recognize that throughout practically the whole of the area with which we are dealing manual labour cannot be undertaken by Europeans. In many parts of the area the climate, and the dangers of disease which I include under the heading of climate, are such that even the task of supervision and leadership by Europeans is often rendered difficult.

There are in each of the five principal mainland territories of East Africa comparatively small areas where the general altitude exceeds 5000 feet above sea-level, where this generalization does not obtain. But even in these highland patches the European requires the assistance of native labour in any work of development which he undertakes.

So for the most part the *rôle* of the European in Tropical Africa, and especially in West Africa, is strictly confined within definable limits. The European in these areas is the administrator, the teacher—using the word in its broadest sense—and the organizer of trade and commerce. He is seldom, if ever, a direct producer.

Before the advent of European rule there was astonishingly little contact between Tropical Africa and the outside world. Africa was practically a sealed continent, both as regards knowledge and trade. But to-day we are confronted by the impact of highly organized Western civilization, with its immense command over natural forces by means of machinery, science, and

skill in the arts on a people and a country in a far more primitive stage of development.

Perhaps nothing brings this out more clearly than the fact that, with the exception of a comparatively slight infiltration of the use of Arabic script from the north-eastern Sudan and from Zanzibar, we have found in Africa no knowledge of writing, and consequently no means of communication between man and man by means of the written word.

We still know astonishingly little regarding the history of the interior of the continent. We learn dimly the traditions of the continual movement of peoples, constant and almost universal warfare, of slavery and the slave trade. We must admit that the first contact between Europe and Tropical Africa was to take a hand in this last nefarious business and up to a hundred years ago African trade and commerce may be summed up in the two words "slaves" and "ivory."

It was only in the last decade of the nineteenth century and the first decade of the present century that the interior of Africa became effectively parcelled out among the principal European Powers. In some parts of it we are still in the pioneer stage, in others we are just passing out of the pioneer stage into a new stage of consolidation.

The history of modern Africa is bound up with the history of the railways which European enterprise is pushing every year into the interior of the continent. Forty years ago there were no railways in Tropical Africa. To-day there are over 10,000 miles, and the locomotive may be taken as the outstanding symbol of this new force which is entering into the continent for the first time.

One other fact is illustrative of our problem. Money is a new thing in Africa. I have visited a market town in Nigeria where I have seen cowrie shells still being used as currency. Twenty-eight years ago the missionaries opened the first post-office in Uganda. British administration had not yet been established, and the missionaries produced their own postage stamps, and the value on those stamps was expressed in cowrie shells, not in pence. To-day something over £3,000,000 in coin and notes is being paid out annually to Uganda natives for their cotton crop alone. In West Africa money has only recently replaced square-shaped bottles of alleged gin and yards of cloth as the medium of exchange.

Money is therefore quite a new idea to the African mind, and it is even true to say of many parts of Africa that the idea that the products of the soil or of the forests have a value in the exchange is a new one. The "economic crop" is really a new factor. The idea that land has a value is a new factor, particularly among the Bantu people of the continent, whose previous agricultural activities were limited to the production of a sufficient quantity of food by each family for that family and as tribute to a chief, while wives and cattle were regarded as the chief measure of a man's wealth.

The farther we push our investigations into the contrast between the old Africa of the past and the new just dawning, the more we have to realize how great is the gulf between them. In the old Africa, disease was regarded as the work of evil spirits, and the prevention and cure of maladies were regarded and are still so regarded in many places, as the task of propitiating these spirits. The European arrives and tells the native that these maladies are not caused by evil spirits but by mosquitoes and the tsetse fly! We must not be surprised if we were not believed.

I do not wish to draw an exaggerated picture, and the marvel is that the

African native is accommodating himself so rapidly, and on the whole so cheerfully, to all this new world that has been brought into his midst.

It is, of course, a mistake to generalize about Africans as a whole, for there are probably just as great differences between the different races of Africa as there are between the different races of Europe, but generally speaking the African is probably the most imitative and adaptable of all races of the human family. He starts with a far cleaner slate than the populations of Asia with their ancient civilizations and intensely conservative traditions.

To the African the steam engine is not so much a foreign devil as a new and wonderful toy. The African, too, has no idea of caste; he is ready to turn his hand to any trade or craft, and to try anything new. He is perhaps even too ready to jettison his old ideas and customs. The Muhammadan peoples of Northern Nigeria, the Sudan, and Somaliland are more conservative and more stable, but for the rest, Africans are eager to adopt hurriedly European clothing and European ideas. The moment they acquire wealth they demand education, and the particular form of education which they seek most is what is described in West Africa as "education for book." The main source of attraction to the Missions is the Mission school.

It is true that the impact and sudden development of the African produce changes which are only skin-deep. This must necessarily be so where things are moving so rapidly. The mere fact that the African native so readily abandons his own primitive paganism for Christianity or Muhammadanism is an indication not that his conversion is ungenuine but that it is frequently not very profound. Reversions and breakdowns are inevitable. Remove the impetus and the example and the African will quickly slip back into old ways. The fact is that both the African himself and we ourselves are setting a very fast pace, and we must expect that the results of our efforts will be frequently superficial.

I have already said that we still know comparatively little about the history and mental traditions and aptitudes of the African native. The work of the anthropologists is yearly widening our knowledge. Anthropology is a science which is rapidly expanding in its scope. It is now recognized that it must include a study of native law and customs, methods of agriculture, beliefs, and languages. Their variety is infinite, and as we are still in the stage of collecting a vast mass of data there has as yet been little time or opportunity to develop adequately the comparative and synthetic side of the work; still less to be able to deduce from our knowledge those lessons which will be most useful in guiding policy. There are so many tribes, so many languages to be studied, and such a variety of local problems, that it is very difficult to ensure that scientific investigation shall keep pace with the practical day-to-day running of Government administration and of economic development. Consequently our methods and the whole character of our administrations in different parts of Africa may seem to be empirical rather than to follow any clear line or consistent principles. We are always supposed to have a natural genius for empiricism, and probably our greatest successes in Colonial Administration are due to the fact that we are naturally suspicious of the doctrinaire, and are prepared to delegate authority to the individual on the spot. Nevertheless we must henceforth clear our ideas on certain fundamental questions which are common to our problem. We can begin to take stock, and judge of cause and effect on the basis of a great mass of ascertainable knowledge.

Perhaps the first problem which we should examine is what is the effect of the European impact and economic development on the numbers and health

of the African population. Africa is a very sparsely populated continent. The group of our six East African dependencies has an area approximately equal to that of British India. Yet in East Africa we have a population of 12½ millions, as against over 220 millions in British India. Even in British West Africa, which has double the population for half the area of East Africa, the population is still sparse. The following table of population densities is taken from the Report of the East Africa Commission :

(1)	Transkei (Cape Colony Native Reserve)	59	per square mile.
(2)	Nigeria	53	,, ,,
(3)	Gold Coast (Colony only)	50	,, ,,
(4)	Basutoland	42·5	,, ,,
(5)	Uganda	33	,, ,,
(6)	Nyasaland	31	,, ,,
(8)	Tanganyika Territory	11	,, ,,
(8)	Kenya Colony	11	,, ,,
(9)	Northern Rhodesia	3	,, ,,

The population per square mile of

England is	701	Japan	339
Belgium	658	Italy	319
Germany	348	France	187

On the other hand, our African territories have a far denser population than our as yet undeveloped Dominions or the rapidly developing countries of South America. The population per square mile of

New Zealand is	11	Australia	2
Brazil	9	Canada	2
Argentine	8		

Naturally these all-inclusive figures do not give a complete picture of the distribution of population. For instance, in Nigeria the population of the great Province of Kano is over 100 to the square mile, while that of Bornu adjoining it is only 23 ! Broadly speaking, however, there is more fertile land in Tropical Africa than there are people to cultivate it, and in the development of Africa it is an axiom that with rare exceptions—such as British Nyasaland—the demand for labour always exceeds the supply. This shortage of available labour is already observable in connection with the native cultivation, as in the cocoa industry of the Gold Coast or the cotton industry of Uganda, quite as much as upon the European plantations of Kenya and Tanganyika.

An increase in the man power of Africa is everywhere required if its resources are to be developed by any means whatever, and it is very important to ascertain what effect European contact and economic expansion are having on the vital statistics of the various territories.

The trouble is that we have very little data to go upon. In regard to many of the territories the 1921 census was really the first one that can be taken as effectively reliable, and the absence of scientific statistics is one of our difficulties. It is only in the Union of South Africa with its far longer history of established government that we have sound figures for purposes of making deductions.

The Royal Society of South Africa has recently published an extremely valuable paper by Senator Alexander Roberts, entitled " A Statistical Enquiry into the Population Problem in South Africa." He proves that the rate of increase of both the European and native populations is astonishingly low, and

seems to be decreasing. Between 1904 and 1921 the white population of the Union has only increased by 1·87 per cent. per annum, whereas between 1835 and 1904 the annual average increase was nearer 5 per cent. A normal percentage increase such as one has the right to expect would seem to be at least three.

Similar results appear from his examination of the statistics of native population. Enumerations show a declining rate of increase everywhere except in Zululand. The native increase throughout the Union was about 2·4 per cent. at the commencement of this century. The figures for the famous Transkei native reserve, containing nearly one quarter of the total native population of the Union, are of special interest. Reliable data are available for that district from 1875 to 1921. The average rate of increase for the whole period is 2 per cent. But for the period 1911 to 1921 the rate has dwindled to 0·68 per cent. per annum.

These figures are significant. They show that even in the healthiest part of the African continent, where modern hygiene and sanitary conditions are more developed, the native population, so far from tending to increase more rapidly, is increasing at an unexpectedly low rate, and that even the rate is diminishing.

When we turn to the more populous tropical areas of the continent we are faced by the fact that we have no scientific data to go upon. A great part of the area has only come under effective administration during the last thirty years. We have only the censuses of 1911 and 1921 to go upon. The 1911 censuses were admittedly far from perfect, and though the 1921 censuses marked a great improvement in accuracy, it is now generally admitted that in many places the enumeration involved estimating rather than actual counting.

There are very few places in Tropical Africa where it is yet possible to secure the recording of vital statistics. In the townships of Lagos and Freetown fairly accurate figures are obtainable, but nowhere else in West Africa. Thanks to the co-operation of the native administrations, useful figures are now obtainable in regard to several parts of the Uganda Protectorate, but elsewhere in East Africa the registration of births and deaths is as yet impracticable, and still more the causes of death.

From such figures as are available we can deduce the fact that in Uganda there can be little doubt that the population declined between 1900 and 1924. Such decline was due to two main causes. First, the great sleeping sickness epidemic of 1902, which caused the death from this disease alone of 300,000 out of 3,000,000 in one year. The second cause of decline was undoubtedly venereal disease. This was particularly striking in the Principality of Bunyoro, where until active measures were undertaken by the British medical staff it was estimated that 90 per cent. of the population had become infected by syphilis. Thanks to the energy of the medical administration the tide has now turned, and during the last two years it would seem that there has been a slight increase —but very slight—in the population.

But, broadly speaking, in East and West Africa the principal cause arresting the natural growth of population is infantile mortality. It has been estimated that in the purely native district of Tanganyika Territory between Tabora and Lake Victoria there is an infantile mortality rate under the age of twelve months of anything up to 400 per 1000. I was recently given the estimated figure of 250 per 1000 in more than one part of West Africa.

The main cause of this very high mortality would seem to be malnutrition both of mothers and babies, and the continuance of barbarous superstitions in

connection with childbirth and early rearing of children. Further, it must be remembered that in many parts of Africa it is the native custom that the women should perform a very large part of the agricultural work on the native holdings. This undoubtedly is affecting the infantile mortality, which has always been abnormally high.

The medical care of the natives, hygiene, sanitation, and preventive medicine are only just beginning to operate in many parts of Tropical Africa. In many places the natives first resort to the witch doctor or the old women, and only come to the European medical officer as the last resort.

It is not surprising, therefore, that in countries where infective diseases, many of them insect-borne, are rampant progress is slight. We must remember also that in many parts of Africa—South-Eastern Nigeria for example—the native methods of agriculture are still so primitive that the existing native diet is quite inadequate to provide the stamina necessary to withstand the attacks of disease. The great prevalence of septic ulcers is due partly to the unhygienic habits of the natives and partly to the low general health and resistance, due to malnutrition. The investigations now being undertaken by Dr. Fisher and others in Kenya into this problem of native diet are most important.

We must admit, however, that over and above these endemic causes the coming of settled rule and civilization has aggravated the problem. Before we established roads and railways and suppressed the tribal wars, communities lived in comparative isolation. There was little trade or intercourse between neighbouring peoples. Now, however, the old barriers are broken down and natives travel all over Africa comparatively freely, with the result that they carry infection with them and diseases have far more opportunities of spreading than heretofore.

I think I have said enough to show what a vast task we have before us in increasing the number and well-being of populations for whom we have become trustees, and I now turn to some of the more important social problems that are arising as a result of rapid economic development.

How rapid this development is few people have yet realized. In 1921 the domestic exports of Nigeria were valued at 8½ millions sterling, in 1925 at 17 millions. Those of the Gold Coast in 1921 were £6,000,000; in 1925 £10,500,000.

Such examples of expansion are sufficiently sensational, but the rate of development in West Africa is completely eclipsed by the rate of progress in East Africa. The domestic exports of Kenya and Uganda in 1921 were £2,250,000, and in 1925 £7,820,000. The corresponding figures for Tanganyika Territory are £1,000,000 in 1921 and £2,900,000 in 1925.

These figures are illustrative of the sudden acquisition of money wealth among peoples to whom in a very large measure such an experience is entirely novel, and there are not a few students of the problem who are inclined to think that the rate of progress is almost too fast.

However this may be, I doubt if we can stop it or should be justified in doing so. Practically the whole of this rapid increase in production is represented by agricultural products and only a fraction by minerals. The two most sensational examples of the expansion have been cocoa in the Gold Coast and cotton in Uganda. The exportation of cocoa from the Gold Coast rose from 7000 tons in 1905 to 78,000 tons in 1915 and 220,000 tons (nearly half the world's total supply) in 1925.

Uganda exported 93,000 bales of cotton lint in the season 1923–24, and the past season's crop has exceeded 200,000 bales.

In both these cases the crops have been produced entirely by what is termed "native production," *i.e.* by the native working for himself on his own holding, or for native chiefs or other native employers of labour.

Apart from the great accretion of wealth to the native producers, the development of a permanent crop like cocoa has an important bearing upon the development of native ideas in regard to land tenure. In parts of Uganda where the chiefs are large landowners, a new relation between landlord and tenant and landlord and labourer is developing.

I should say that the main effect of this economic development due to the native production of money crops is the enhancement of the individual *vis à vis* his society. In the old Africa society was largely communal, the rights and functions of the individual being entirely subordinate to those of the tribe or the village. With personal wealth an individual becomes emancipated from the former limitations and controls, and his first instincts are to better himself and his family not only in the economic but also by using his wealth to better himself in the social and political spheres.

The nature and sanctions of tribal authority are undergoing rapid changes, due in part to these economic causes and in part to a more profound spiritual and moral change. In many parts of Africa the two principal sanctions behind the chief's authority were formerly military and religious. The chief was not only the tribal or national leader for purposes of defence and offence, but also the guardian of the national fetishes and the chief executive of native law and custom, which are bound up ultimately with religious sanction. Consequently the missionary in converting the individual native to an individualist religion such as Christianity must inevitably sooner or later affect not only the sanctions behind native political authority, but also the whole moral order associated with that authority.

In the coast towns of West Africa, where European contact has been established for a longer period than elsewhere in Tropical Africa, we observe this decay in tribal authority and the development of the individual in its highest degree. A very large proportion of the population of these towns is completely de-tribalized and no longer bears any allegiance to a native authority.

Some people go even further than that and describe these individuals as "denationalized." That is to say, we are witnessing the rise of a new community of people who have thrown off all their ancestral traditions and are engaged in imitating Western civilization as fast as they can. Certainly the demand for Western education, particularly Western literary education, creates a most formidable problem and throws special responsibilities on Government and missionaries alike in providing the right type of education for the African with his special characteristics, still living in Africa but in a new and rapidly changing environment.

Hitherto we have been perhaps too easily content to give the African a mere veneer of the nineteenth-century English Board-school education without studying the real needs of the people or the right methods of bringing out their innate capacity on modern scientific lines. This is why a great experiment like the Prince of Wales College, Achimota, in the Gold Coast, is fraught with so much interest not only for that Colony but for Africa as a whole.

There are so many disruptive tendencies at work in Africa to-day that constructive thinking is urgently needed if the African communities are not to be reduced by our impact to the condition of disorganized mobs drifting about without leadership and without any clear goal before them except the new desire to acquire personal wealth.

I turn now to another aspect of the problem. Both deliberately and also unconsciously we are teaching the African the mastery of new arts and crafts, new methods of agriculture, and in some cases entirely new methods of life. In Tropical Africa we are forced by the difficulty and expense of running things like railways with European staffs, unsuited to the climatic conditions, to develop the skill of the African. He is being trained to become an engine driver, a fitter, a mechanic, a stone-mason, and a carpenter. Every year he is being entrusted with the management of more and more complex machinery, and every year sees an increase in the number of quite highly skilled African industrial craftsmen. Our recent experience shows that the African can very readily acquire skill in the mechanical arts, and is capable of becoming an industrial craftsman of quite a high order.

Thus we are training up a new African labour class of wage-earners for the most part in the employ of the various Government Departments, but in West Africa also in the employ of the mining companies and in East Africa in the employ of the European farmer settlers.

In the old Africa wage labour was largely unknown. Compulsory labour for communal purposes was a fairly general rule, while in many places, particularly in West Africa and those parts of East Africa which had become subject to Arab domination, slavery was general for nearly all labour purposes. We have suppressed slavery and regularized the amount of compulsory labour which may be performed for chiefs or Government, and prohibited the employment of forced labour for purposes of private gain. That such drastic changes in the customs of the continent have already produced great economic and social changes—in this case for the better—must be obvious.

Nevertheless the labour problem in Tropical Africa is a most important one. As I have already stated, there is a far greater demand for labour than supply. There is no unemployed problem such as we have in Great Britain. On the other hand, there is not the same necessity for the African native to work as there is for the European. In Africa nature is bountiful, and food can usually be easily and cheaply obtained. The climate is such that the cost of housing and of such clothing as may be required is comparatively insignificant. The wants of the ordinary African in his present stage of development are few, and therefore the incentives to effort are far less insistent than in temperate climates and more civilized conditions.

In the old Africa—especially Bantu Africa—a young man's life was very largely taken up by fighting, with the preparation for fighting, and with hunting the wild game. Now that tribal warfare has ceased there is a real danger that deterioration will set in unless the energies formerly expended upon fighting are diverted to honest toil. To allow the manhood of a race to remain dependent on the labour of its women-folk is bound to result in national decay. I see nothing wrong in encouraging the African to work either as a direct producer or as a wage labourer. In fact, his advance in the scale of civilization is bound up with his economic advance as a producer. Nevertheless it is our duty to ensure that such a new development is made consistent with the lessons of experience concerning the welfare of labour and the best relations between employer and employed.

A good deal of discussion is going on just now regarding the treatment of native labour engaged on capitalistic enterprise in the development of the continent. In Tropical Africa the Governments, notably the Railways and Public Works Departments, are by far the largest employers of African labour, and they set the standards. Then there is the wage labour engaged in the

mining industries and upon the farms of European and Asiatic settlers in East Africa, and on the larger native farms in parts of West Africa and in Uganda.

In the past year there have been published two very important reports dealing with this problem. The first is the ' Rapport de la Commission pour l'étude du problème de la main-d'œuvre au Congo Belge,' issued by the Government of the Belgian Congo in 1925 ; and the second is the report by Major G. Orde Browne, Senior Commissioner of Tanganyika Territory, on labour in that country issued last month by H.M. Stationery Office as Colonial Paper No. 19 of 1926. The last named is the most interesting and objective study that has yet been made by an experienced British native administrator on this subject. It touches upon almost every aspect of the question. It reveals great diversities of practice, and Major Orde Browne's observations on the data which he has collected are of the highest value.

There are, of course, many varieties of labour engaged in work on the same plantation. There is often the nucleus of permanent labour—squatters as they are often termed—who live permanently with their families on the estate. Then there are the contract labourers, recruited often from great distances, who work for six months or a year and return to their homes at the conclusion of their contracts. Thirdly, there is casual local labour—usually harvest labour—drawn spasmodically from the neighbourhood. Each category requires special investigation.

Without going deeply into these questions I should like to quote some of Major Orde Browne's conclusions.

He writes : " The impact of the capitalistic system upon the African social organization in Tanganyika has not the dangers that it would have elsewhere ; the almost entire absence of any class earning a living by industrial crafts eliminates the tragedy of the gradual crushing of such a class by mechanicalized competition, and there is no fear of a duplication of the situation which has arisen from this cause in Indian industrial centres. The African is self-supporting through his own agriculture, and if he goes to work for wages it is primarily to secure money for hitherto unrealized needs or luxuries. The class sometimes termed " wage slaves "—*i.e.* people who are forced by economic pressure to work willy-nilly at some particular task—is non-existent in Tanganyika and likely to remain so.

" The introduction of non-native enterprise has conferred a real boon on the African, since it has tended to regulate and equalize the extreme fluctuations resulting from the success or failure of the harvest. Whereas in former years a bad season might entail literal starvation for great numbers, it is now largely mitigated by the possibility of work on a property that provides foods as well as money ; while improved transport consequent upon economic development has also done much to ease the situation created by a bad harvest.

" In another direction the native benefits to a minor though still appreciable extent from work on a plantation : it secures him adequate food at a time when the natural improvidence of the African has possibly led to a shortage before the new crop is reaped. That this aspect is fully appreciated is proved by the flow of labourers seeking work during the hungry months ; I have, in fact, frequently been told by natives that they were going to work because the food in the village was growing scarce. It is indeed quite possible that this feature will have a beneficial effect on the whole population in time, for there is no doubt that at present many tribes are definitely under-nourished towards the approach of the new harvest, not through any failure of the previous one, but

because the thriftlessness of the African frequently leads to inadequate storage or excessive sales.

"The creation of large industrial centres with workers completely divorced from food production would be an entire innovation of very doubtful desirability; it appears most unlikely to occur. The African man, and still more the woman, is firmly attached to the soil, and the whole fabric of social organization is based upon the right to cultivate; it thus seems probable that the native will always aim at having his own home among his own crops, whether in a distant village or as a 'squatter' on an estate."

I think it is quite clear that there are four main duties which we have to perform if we are to render the impact of European civilization upon the African not only innocuous but in the long run beneficial to the latter's welfare. We have in the first place to concentrate upon the various problems summed up under the words "public health." We have in the second place to improve the standard and quality of the native as an agricultural producer both of food and economic crops. Thirdly, we have to provide for further transport facilities both to secure the wider marketing of African products and to secure that in the movement of labour there is not the same wastage as obtains at present. Fourthly, we have to educate the native in such a manner that, whether he is a direct producer or a wage-earner, he may advance in the scale of civilization and assimilate such new moral controls as will fit him to withstand the dangers and make the best use of increasing wealth.

As regards the second point, I think we must recognize that throughout the greater part of Tropical Africa below the 5000-feet altitude native production under the guidance of European agricultural officers is the only practicable policy. Where there are highlands—and it so happens that these highland areas are at present very sparsely populated by Africans—European colonization can be introduced. Personally, I hold that this European colonization, so far from being detrimental to the native, may be of the highest educative value. The European farmer and stock-owner introduces examples of more scientific development, and I think it is already clear from the experience of Kenya that no small proportion of the natives who have worked on European plantations have learnt not only improved methods of cultivation which they can apply on their family holdings when they return to their reserves, but also something of a higher standard of life.

There are many plantations, particularly in Kenya, where an ever-increasing interest is being shown in the housing and sanitation of native labour. The settler's wife is frequently quite as valuable as her husband in educating up native labour not merely to be a more efficient labourer, but to be a better man.

The recent articles in the *Times* from the pen of Mr. J. H. Oldham are among the most striking that have recently appeared upon native policy in Tropical Africa. He has clearly come to the conclusion that Kenya presents not merely a series of problems of local significance but offers an almost unique opportunity for an experiment in racial co-operation, which, if wisely directed and based upon a scientific study of cause and effect, is perhaps more full of promise than any experiment that has hitherto been tried.

I think it is clear that in East Africa, where the contact between European and native is probably closer than elsewhere, and the mutual interdependence most marked, we have an opportunity, such as seldom presents itself, for working out on scientific and humane lines the various contributions which European civilization can give to the African races without destroying what is valuable and distinctive in their characteristics.

European colonization, in the few areas where it is climatically feasible, has been the principal means of introducing not only a new crop but a whole series of new ideas which can contribute to the advancement in the scale of civilization of the peoples for whom we have become trustees. It is now generally accepted that throughout Tropical Africa we are in the position of trustees. In the words of Article 22 of the Covenant of the League, we are entrusted with the guidance of "peoples not yet able to stand by themselves under the strenuous conditions of the modern world."

The field of work covered by the phrase "public health" is a gigantic one, especially in Tropical Africa. In addition to certain diseases peculiar to the tropics, we find practically all the diseases common to temperate climates. Some of the latter appear to have been introduced as a result of European contact, and with regard to these it sometimes happens that, being new, there is no acquired resistance on the part of the populations affected. As an instance, I was told in my recent tour in West Africa that an African who gets tuberculosis rarely, if ever, recovers.

The special tropical diseases, such as malaria, sleeping sickness, and the like, appear in both endemic and epidemic forms. It sometimes happens that an infectious disease will suddenly flare up and spread in tropical conditions with terrible results. The task of combating these epidemics is a gigantic one, and the field for research as well as treatment and cure is still large. I cannot overestimate the importance or value of research workers of all kinds in Africa.

I include in this field and in the field of "public health" the animal as well as human diseases. The scourges of rinderpest, pleuro-pneumonia, East Coast fever, red-water fever, and trypanosomiasis require the services of an increasing number ot veterinary research officers and veterinary staff throughout Tropical Africa.

We have been so far able to do little in the way of developing the immense potential resources of Tropical Africa in animal foods. I am told there are something like 6,000,000 head of cattle within 200 miles of the Uganda railway system, but at present there is no export of meat, and the first small shipment of East African butter reached England this summer.

In Northern Nigeria there are approximately 3,000,000 cattle cut off from the coast by a wide belt of tsetse-ridden country.

The development of animal husbandry is still in its infancy, as it is only in the European highlands of East Africa and among a few natives in Uganda and Tanganyika that the plough has been introduced. Elsewhere the land is cultivated by means of exclusively human labour with the hoe.

Finally there is transport. In many parts of Africa the principal means of transporting produce is still the human carrier. The human carrier is the most expensive and wasteful form of transport, as each individual is limited to an average load of approximately 60 lbs., with a speed of 15 to 18 miles a day.

During my recent tour in West Africa I was at great pains to collect some figures regarding the comparative costs of different forms of transport. In the populous cotton-growing area round Zaria in Northern Nigeria head transport costs from 2*s*. 6*d*. to 3*s*. 6*d*. per ton mile, motor transport 1*s*. per ton mile, and animal transport 9*d*. per ton mile, but the railway is carrying cotton and ground-nuts at approximately 1½*d*. per ton mile. There can be no doubt that in the conditions of Tropical Africa, where roads are difficult to construct and even more difficult to maintain, the railway is by far the cheapest, as well as by far the most expeditious form of transport.

We are only at the beginning of the construction of our arterial system of railways. In the bulk of our African possessions such railways as do exist not only pay directly but their indirect effect in bringing about production is sensational. When the railway from Baro to Kano was first constructed it was estimated that two trains a week would be all that would be required to carry the produce. When I was in Kano in February this year the average number of goods trains leaving Kano was eight per day, and the tremendous expansion of the cultivation of ground-nuts round Kano is due entirely to the coming of the railway. The export of ground-nuts from Nigeria has risen from nil in 1910 to 120,000 tons last year. Similarly the expansion of cotton cultivation in Uganda is the direct outcome of the Uganda Railway and the feeder roads and water transport provided as auxiliaries to that railway.

Railways without roads are of little value, but I have definitely come to the conclusion that in the conditions of Tropical Africa roads are no substitute for railways. Tropical rains alone prevent the use of roads except during the dry seasons of the year.

Cheap transport is the life-blood of commerce, and everywhere I have been in Africa I have met the same demand by European and native alike for the provision of more roads and more railways. An example of the comparative stagnation of a naturally rich and populous country where the transport facilities are at present inadequate is provided by Nyasaland, where, in consequence of the incompleteness of Lake Nyasa's communication with the sea, some thousands of the most progressive natives leave the country every year in search of opportunity in more developed parts of Africa.

As in the other questions that I have discussed, the right solution of the many transport problems which arise in Africa can only be brought about by scientific study, and we should do well to watch all new developments in the means of transport, in new fuels, and such-like matters which have a bearing upon any undertaking.

It is quite clear that we cannot develop either the land or the people unless we have easier and quicker means of access which modern rapid transport alone can give, but every line of railway we open, every road we construct, adds to the pressure of the impact of our coming, and I feel that in addition to research into all these practical sciences we shall require in ever-increasing degree the scientific observation of the sociological facts of our development; mere humanity and enthusiasm are not sufficient. We have to study the problems we ourselves are creating with a considerable degree of objective detachment and make certain that in our natural zeal for material development we are not disrupting more than we are creating. Here again it is Kenya that is leading the way, and the Kenya Government have asked that a portion of the loan to be spent on transport development in East Africa shall be ear-marked for the closer scientific study of what is rather loosely called "the native problem."

I think I have said enough to show that both our opportunities and our responsibilities in our African Empire are very great. We can only solve our problems by applying to them the energies of our best brains working in a spirit of objective detachment, studying failures and successes with a view to building up gradually a body of knowledge and experience which will render mistakes few and successes great. In this task we shall have to rely not only upon the continued efforts of those officials and unofficials who are actually working in Africa, but also on the men of science over a whole range of human experience such as are meeting under the auspices of the British Association.

There is no finer field for scientific investigation and endeavour than our

tropical dependencies, and I should regard myself as fortunate if I were able on this occasion to arouse your interest in matters of great importance not only to the Empire but to the advancement of human welfare.

NEW WAR OFFICE MAPS OF AFRICA AND ASIA

TWO important series of maps, one of Africa and one of Asia, are, and have been for the last few years, in course of publication by the Geographical Section of the General Staff. These maps are the series covering Africa on the scale of 1/2,000,000, or about 32 miles to 1 inch; and the series covering Asia, on the scale of 1/4,000,000. The preparation of each series was due to the initiative of the Royal Geographical Society. The Society compiled in manuscript seven sheets of the African map, and one of the Asian map, during the War; after the War the work was taken over by the War Office, and much progress has now been made. Each series is, in fact, sufficiently advanced to make it desirable to draw the attention of Fellows of the Society to what is, in reality, a notable addition to the fundamental outfit of the geographer.

The designer of a series of maps is faced at the outset of his labours with the necessity of making up his mind about the most suitable scale for the purpose in view. Nowadays it is becoming increasingly common, in the construction of maps of large portions of this world's surface, to adopt a scale which is a multiple or sub-multiple of the million scale. And this custom has certain conveniences. We are all getting accustomed to scales in "millions," and maps on these scales may be made to fit into the framework provided by the standard International Map ("Carte du Monde"), on the 1/1,000,000 scale, and they may be said to help the latter undertaking; for in the compilation on the smaller scales one can get a pretty shrewd idea of the amount of reliable material available for the standard map.

The next decision which must be made by the designer of a series of maps is the more difficult one of the projection to be adopted, and in this matter there are these two general alternatives: Either the sheets may be made to fit together exactly, so that each will join on to its neighbours without any gaps, the projection being constructed for the whole series, which is treated as one map; or we may construct each sheet independently of its neighbours, so that we cannot, with minute accuracy, fit together even a small group of sheets, but each individual sheet will have very small errors. In this latter case we may very well adopt a polyconic projection, especially that modification of it which has been chosen for the "Carte du Monde," and this projection has, as a fact, been selected for the African series in question.

In the "Carte du Monde" the largest error of linear scale is 1/1270, a negligible quantity. But the weak point of the projection is discovered when it is intended to fit a group of sheets together. We can fit an indefinite number together bounded by the same meridians (6° apart), or by the same parallels (4° apart). But if we try to fit together a group of, say, four sheets, two sheets in depth and two in breadth, this is what happens. Fit two together bounded by the same parallels, say the two southern sheets; then fit the southern parallels of the northern sheets on to the northern parallels of the southern sheets; these will fit accurately because the parallels are of the same length and have the same curvature. But now we shall find a gap between the inner meridians of the northern sheets; the meridians will diverge from the centre of the group. M. Ch. Lallemand has shown that, in the case of the "Carte du

Monde," the divergence, or angular hiatus, amounts to 25′ as a maximum, an amount which cannot be said to cause serious inconvenience.

With a scale of 1/2,000,000, and sheets of the same size of paper but embracing twice the extent in latitude and longitude that the sheets of the 1/1,000,000 do, the maximum linear error is still small, viz. 1/315, and this is quite unobjectionable. But a small calculation will show that the maximum angular hiatus now amounts to about 101′, and the fitting of the sheets together is beginning to be more than a little awkward, especially near the Equator. If the sheets are fitted together, as described, with an angular hiatus of 101′ the linear hiatus on the northern parallel will be about 1·2 cms. in the worst case; whereas with the "Carte du Monde" this maximum gap is only 3 mm. We have, in fact, reached, or perhaps more than reached, the limit of applicability of this system, when we make use of it for the 1/2 Million scale. But it is difficult to suggest a better projection for maps of Africa on the scale in question.

The map of Asia is on the 4-million scale, and the polyconic projection was wisely abandoned, and a projection was chosen to cover the whole continent. The projection adopted was the conical orthomorphic with two standard parallels. The whole map extends in latitude from the equator to 80° N., and in longitude from 30° E. to 180° E.—from Singapore to the Arctic, from Smyrna to Bering Sea. The errorless parallels are 27° N. and 63° N., so that there is perfect representation along a line through Northern Arabia, Baluchistan, Northern India, Yunnan and Fuchien, and also along a parallel in Northern Siberia, not far from the Arctic Circle—which is, perhaps, treating that inhospitable region a little too kindly.

From the nature of the case, since the projection has been designed for the whole map, the sheets fit together perfectly—at the expense, of course, of considerable variation in the scale. The scale error varies from −4 per cent. about the parallel of 45° to +21 per cent. on the Equator; or, putting the scales in fractions, from 1/4,174,000 to 1/3,137,000. In fact, along the Equator, which passes through Sumatra, Borneo, and Celebes, the scale is nearer 1 to 3 millions than 1 to 4 millions. This large variation in scale in the habitable region of Asia is, in part, due to the tenderness with which the Arctic regions have been treated, and in part to the choice of an orthomorphic projection. If, for instance, the main part of the projection had been treated as that extending from the Equator to 60° N., and if a simple conical projection with two standard parallels had been chosen, the maximum linear scale error could have been reduced to about 6½ per cent. There is, of course, no universally acceptable solution for this sort of problem, but the present writer must admit a preference for small linear scale errors in the habitable parts of the continent.

The sheets of the African series are, as has been stated, similar in size and construction to those of the "Carte du Monde"; but there is a slight variation from what might have been expected in the arrangement of the sheet lines, for the Equator bisects a line of sheets, instead of forming the boundary between two lines. These sheets are of a convenient size to handle. The southern sheets of the Asian series are somewhat unwieldy, being about 3½ feet long from east to west; the other sheets are of fairly comfortable sizes, but it might have been better to follow the example of the "Carte du Monde."

There is an understanding between the British Geographical Section of the General Staff, the French authorities, and the Survey of Egypt, that the whole of Africa shall be mapped on the 1/2 million scale; the whole undertaking will comprise thirty-eight sheets, each sheet embracing, in the ordinary

case, 8° of latitude by 12° of longitude. Of this total, the Geographical Section, General Staff has completed no fewer than eighteen sheets, the French have published three provisional sheets, and the Survey of Egypt one.

The 1/4,000,000 series of Asia, which is being issued by the Geographical Section, General Staff, comprises seventeen sheets, but two of these cover ocean areas only. Of the remainder, nine have already been published, and it is understood that three more are in course of preparation. South of 60°, each sheet of this series embraces 20° of latitude by 30° of longitude.

So much for the framework of these two series. As regards their style and character, they are both printed on the "layer" system; that is, they are hyposometrically coloured. The system of tints is, generally speaking, well chosen, and approximates to the international scale of colours. The later sheets have somewhat bluer greens than the earlier ones, and this is an advantage. The tints which represent the very high altitudes on the African series are somewhat crude as compared with the scale of colours printed for guidance in the construction of the "Carte du Monde" and published in the official report, but there is not very much of this high ground in Africa, and the appearance of the sheets is not materially injured. The sheets are generally pleasing to look at and easy to read. It is a treat to study such sheets as "Kenya Colony," "Transvaal," or "Natal"; you can get more geography out of ten minutes' study of such sheets than by reading volumes of descriptive writing. The same remark applies to the 1/ 4 million series of Asia; take, for instance, the sheet which has the title "Persian Gulf," which really includes Egypt, Sinai, Palestine, Syria, Anatolia, Kurdistan, Northern Arabia, Iraq, and the greater part of Persia. It is an admirable example of clear and accurate cartography, and should be in the possession of every one interested in Eastern problems.

A few minor points may be noticed. The writing departs, in some instances, from the conventions laid down for the International Map, especially in the free use of sloping "stump" for small towns instead of the upright "Roman hairline." But of course there was no obligation to use the international convention for either series. The choice of names is always a difficulty; but generally the number of town and village names gives a fair idea of the density of the population; though it is inevitable that some alterations of standard should take place in changing from a densely populated to a forest-clad or semi-desert region.

It would add greatly to the interest and geographical usefulness of both series if the sea-bed contours were given, and if the seas were provided with layer tints, as laid down for the International Map. The "Gamme officielle" provides for changes of the blue tint at 200, 500, 1000, 3000, and 5000 metres of depth below the surface. Perhaps this improvement might be considered for the next editions.

However, these are minor matters. In the main we may say that the Geographical Section of the General Staff has laid geographers under a real obligation by the publication of these two admirable series, giving us clear, accurate, and reliable maps of two continents, based on the best and most recent available information and printed in a way which reflects much credit on that efficient branch of the public service. More than half of each series has now been issued, and we look forward to the speedy publication of the rest.

C. F. CLOSE.

Note by the Secretary.

Sir Charles Close will allow one who was implicated in the beginning of these maps to explain what was in mind when the projection of the Asia 1/4 M was chosen. The map was intended for continental Asia, which is included mostly between 20° and 70° N.; therefore, following the rough rule suggested by Sir Charles for the simple conic with two standard parallels, the selected parallels were 20° + 7° and 70° — 7°; that explains why 27° and 63° were chosen. Fuller consideration might have shown that the rule was not so suitable for the conical orthomorphic: but there was little time for consideration in 1917.

The map was planned for the scale 1/ 5 M, which is why it covers the limits of twenty-five sheets of the 1/ M map, five aside, not four aside, as would have been more natural for the scale 1/ 4 M on which the G.S.G.S. published the R.G.S. drawing of the Manchuria sheet and continued the series.

It was not contemplated that the map would be extended to the Equator, because Southern Asia seemed to be adequately provided for in the Survey of India 1/ 2 M, whose limits shown on their index are 0° to 48° N.; 36° to 132° E. The index to proposed sheets made at the R.G.S. in 1918 has only three rows, between 20° and 80° N. But the table of coordinates for the projection, calculated by Mr. A. E. Young, was carried, perhaps with undue zeal, to the Equator; and that may have tempted the G.S.G.S. to extend the map southward, by an extra row, beyond what was in the original plan. Anyhow, it was no undue tenderness for the inhospitable Arctic that was responsible for the choice of standard parallels. On the contrary, in choosing them we deliberately ignored, as explained above, the strip between 70° and 80° of north latitude, though the sheets had to include that strip. But we did not anticipate that the centre of interest of the map would be shifted southward in other hands, so that while no sheet of the northern row has been even begun, one sheet of the added southern row has been actually published, and another is in preparation.

As for the choice of an orthomorphic projection: it seemed to have certain advantages in rapid compiling, since smaller areas of larger scale photographed or pantographed down were more readily incorporated than if a projection had been chosen in which the scale was different in different directions at any point. Very likely this advantage was overestimated; but Lambert's Conical Orthomorphic with Two Standard Parallels was much in our minds at that time for other reasons. And I cannot help thinking that I at any rate imagined then, as I did until I tested it at the time of writing this note, that the Russian 40-verst map was, like the 10 verst, on an orthomorphic projection. Measurements just made show that it is not. And if we had carried out the original project all the northern sheets would have depended greatly on the Russian 40 verst.

The 1/ 2 Million of Africa was laid out with the Equator central in a row of sheets, instead of being a sheet margin of two rows, because that arrangement fitted Africa better, being economical in the number of sheets; preserving "natural regions" like the Congo Forest, British East Africa, Abyssinia, and others conveniently within the borders of sheets; and generally looking more symmetrical. For the same reason the meridian of Greenwich is also central in a column of sheets, not a sheet line. The Africa 1/ 2 M was probably the first map of smaller scale built up of the sheet lines of the 1/M maps as units. It seems well to retain the liberty of building up those units as one will, and not to expect adherence to principles of the 1/M map that prove inconvenient

and expensive. The details of the projection and the principles of compilation were pretty fully described in the paper "Notes on the Construction of a General Map of Africa, 1/Two Million," published in *G.J.*, **52**, 218, October 1918.

A. R. H.

RESULTS FROM THE DE FILIPPI EXPEDITION TO THE KARAKORUM

1. **Paesi e Genti del Caracorùm—Vita di Carovana nel Tibet Occidentale.** (Pubblicato sotto gli auspici della R. Società Geografica Italiana.)— **Giotto Dainelli.** 2 Vols. $10\frac{1}{2} \times 7\frac{1}{2}$. Firenze: Luigi Pampaloni. 1924. Vol. **1**: Pp. viii. + 291, *Portrait of Author (frontispiece), LXXIII. Plates of Photographs.* Vol. **2**: Pp. 323, *LXXXV. Plates of Photographs. Map (a new map, specially compiled, in 4 Sheets, 1 : 750,000); 2 Sheets in Pocket at end of each volume.*

2. **Spedizione Italiana De Filippi nell Himàlaia, Caracorùm e Turchestàn Cinese** (1913–14).* Series II. Risultate geologici e geografici, Nicola Zanichelli, Bologna. Vol. **8**, Le condizioni delle Genti.— **Giotto Dainelli.** 4to. Pp. vii. + 418, 38 *Illustrations in Text, Statistical Appendix,* 10 *Maps,* 87 *Plates of Photographs.* Vol. **9**, I Tipi Umani.— **Giotto Dainelli e Renato Biasutti.** 4to. Pp. 332, 14 *Illustrations in Text, Statistical Appendix,* 6 *Maps,* 87 *Plates of Photographs.*

THE scientific aims of the De Filippi Expedition (1913–14) were far-reaching; no scheme of regional exploration has ever been planned more carefully and more completely carried out. An enormous field of work fell to Sig. Giotto Dainelli, Professor of Geography at Pisa University, a well-known naturalist, geologist, and glaciologist, with experience of exploration in Eritrea. Wide reading of authorities, and the observations made by Dr. De Filippi during the Abruzzi Expedition, convinced Professor Dainelli that certain ethnological problems required detailed investigation, and therefore he made a special study of anthropometry.

While the members of the main party were occupied in geodetic and meteorological observations at various selected stations, Dainelli spent most of that autumn, winter, and spring in travelling hither and thither in Central Kashmir, and later in Eastern Kashmir. 'Paesi e Genti' is a delightful narrative of the author's experiences from his departure in August 1913 to his return in October 1914. Originally written for his friends and relations, this personal record has been printed for the benefit of a much wider circle. It would be impossible in a short review to reflect even a gleam of the charm of these two volumes. Part of the charm lies in the simplicity, directness, and humour of the writing; part, in the light-hearted accounts of the great hardships of those winter and spring journeys, often without any European companion, at elevations varying between 15,000 and 20,000 feet and arctic conditions; part, too, in his ungrudging admiration of his native attendants. But perhaps the most striking

* The scientific results of the expedition will eventually consist of fourteen volumes. Series I.: Geodesy, Geophysics, Meteorology (3 vols.). Series II.: Geology and Morphology, Glaciology, Anthropogeography, Ethnology, Botany (10 vols.), and the "Storia" or General Report. Reviews have appeared in the *Geographical Journal* of Series II., vol. **3**, Glaciology (Dainelli) (**43**, p. 243) and of the "Storia" (De Filippi) (**46**, p. 254); and in *Nature* (Feb. 1926), Series I. vol. **1**, Geodesy (Alessio).

feature is the unconscious revelation of the author's insight, of his intense devotion to his scientific work, and of his attention to accuracy and detail. The excellent new orographical map, and the splendid panoramas and photographs, enable the reader not only to follow every stage of the journeys but to visualize the nature of the country and therefore to appreciate fully the vivid word-pictures, many of them gems of description.

The narrative should be read for itself, and again as an introduction to the two volumes of severe scientific results. The maps and illustrations in these two volumes are so numerous and so excellent that it seems ungracious to ask for more! Yet it is undeniable that an orographical map of Central Kashmir, such as that in the narrative volume, is essential to ease of following the detailed descriptions.

The first part of Vol. 8 deals with characteristics of the dwellings, centres, and oases. About 100 pages, §§ 2–15, are devoted to an almost too elaborate technical account of the external and internal features of the dwellings in the whole area, including the tents of the nomadic Changpa. Plans are given of a considerable number of various types of houses, small and great, and some seventy-five admirable photographs. The author claims that in each of the six groups into which he divides the population, viz. Balti, Brokpa, Puriki, Maknopa, Ladakhi, Changpa (see Map III., vol. 9) the dwellings are quite distinguishable one from the other, though the type is essentially Tibetan; the Ladakh type is nearest to that of Lhasa, while the Balti type shows a "modification or degeneration," possibly due to climatic or economic differences. In the mixed belt, near the Srinagar–Leh caravan route, the Puriki houses exhibit intermediate forms. The Maknopa and Brokpa houses differ more widely from their neighbours, and the names given to the parts of their dwellings and outbuildings are Dard, not Tibetan. Contact with the Ladakhi has led the Changpa, here and there, to abandon their nomadic life, but their houses, in their internal arrangements, show unmistakably that they were built round an original tent as nucleus.

The next eighty pages, §§ 16–24, are more or less directly concerned with the character and position of the centres of population. The descriptions of individual centres are most illuminating, but the discussion enters into great detail, and the reader is often tempted to ask whether the extreme attention to logical order does not entail too much repetition. A distinction is drawn between *centri minori*, purely agricultural, and *centri majori*, where there is a certain amount of commercial exchange shown by a bazar, very rudimentary except at Leh. An extremely interesting account of the economic life on the oasis of Tolti, one of the *centri minori*—illustrated by a large-scale map (Plate VI.) is given on pp. 150 *et seq.* The six *centri majori*—Dras, Kargil, and Leh, on the caravan route; Skardo, on the branch route to Gilgit; Shigar and Kapalu, off the main routes—are described in detail and illustrated by many photographs and two large-scale maps—Skardo and Shigar, Plate II.; Dras, Plate III. The relative aggregation of groups of houses forming a centre, or their relative isolation, depends on geological conditions, modified by the possibility of irrigating the relatively small areas where alluvial or morainic deposits offer suitable soil. Obviously these conditions, as a rule but by no means always, are to be found in the *lower* parts of valleys. Many examples are, however, given of centres on terraces of dejection at a considerable height above the river. Here as elsewhere water, the prime necessity, is obtained from springs or from streams by means of small but ingenious gravitation canals and primitive aqueducts, or even by "artificial glaciers," described on p. 143. The majority

of the centres are placed at the mouths of lateral valleys, mostly on alluvial fans. Ignorance of raising water by mechanical means and the extreme variations between flood- and low-water level prevent the utilization of possible areas of cultivation in the lowest parts, near the great rivers. Interesting descriptions are given, §§ 22 and 23, of abandoned and of temporary settlements, and of the winter and summer quarters of the nomads. These are followed by a valuable discussion (§ 24) on the maximum elevation of permanent habitation, with a sketch-map, p. 177, embodying the general conclusions and showing the much higher maxima of the south-east.

The last fifty pages turn to other matters: § 25 deals with (*a*) *means of transport* and describes in detail the porters, horses, yaks, etc.; (*b*) *means of communication*, the rudimentary roads, rock paths and galleries, bridges and other means of crossing the rivers. In the last sections, §§ 26–31, the ancient routes across the Karakorum glaciers (Map VIII.) are carefully analyzed. In the author's opinion, their abandonment was due to fear of Hunza marauders, and not to any increase in glaciation.

Part II. deals with Population; Distribution and Density; Economic Products. After a useful discussion on the value of early estimates, the Census figures of the total population for 1891, 1901, 1911 are quoted in Table I., p. 237, and reasons are suggested for the curious variations in the rates of increase.

The next forty pages, §§ 33–36, are devoted to an analysis of the data required for a reasonably true understanding of the relative density and concentration (*addensamento*) of the population in regions like Central Kashmir, where there is a vast preponderance of land which cannot be permanently inhabited. In such cases, density maps based on large administrative divisions are worse than useless. Unfortunately, the Census and the Assessment Reports give no information on the exact limits or areas of the minor administrative divisions. In order to obtain a basis for further calculations, Professor Dainelli worked on an original 1 : 500,000 map, from which the 1 : 750,000 was reduced. He divided Central Kashmir into twenty-five "geographical regions" by river basins and their subdivisions, which he could limit accurately on his map and whose area he could measure with a planimeter. The results are given in Table II., p. 245,* Table III., p. 246, and Map IX., and are followed by certain general inferences on the density of population. A valuable Appendix, giving the number of houses, inhabitants, sex, religions in the 466 centres of the three *Tessils*, leads to the next step. This detailed information, hitherto unpublished, was communicated to the author by his friend Hashmatullah Khan, *Wazir Wazirat* of the Trans-Himalayan provinces of Kashmir. Although the Census and Assessment Reports state the total areas of land actually cultivated in each *Tessil*, and hence calculate the relative concentration of the population in each, details are given only for the *Skardo Tessil*, and even these are too vague to be useful. But even if full details had been available, Professor Dainelli is of opinion that other matters should be taken into consideration besides mere areas of cultivation. Some weight must be given to paths and roads, to alluvial terraces with soil suitable but not utilized, and to

* (1) It may be useful to remark that 1 kmq. = 0·386 sq. mile, and that therefore a density of 10 per kmq. = 25·9 per sq. mile. Obviously the author used some other factor in converting the Census results (Table II., line 5), but the slight difference does not affect the argument.

(2) Dainelli's total area is considerably less than that given in the Census Report. He remarks that he cannot discover how the Census figures have been obtained.

areas of pasture, however thin, used for summer grazing. As the result of his extensive observations, he considers that a much truer view of the real density is obtained by allowing a 1-kilometre strip along each minor valley, and a 2-kilometre strip in each major valley, giving however the actual width in the parts which he had specially surveyed. This device, and the information given in the Appendix, enabled him to subdivide each of his "geographical regions" into small groups of centres, ninety-eight in all, and to calculate the area of the land utilized, and hence the true density of each group. The results appear in Table IX., pp. 263–266, and in Map X. (with obvious exaggeration of the strips). A full discussion of the results follows the Table.

The next groups of subjects are various and most interesting: § 37, Number and distribution of dwellings; § 38, Number and distribution of centres; § 39, Various proportions of the sexes; § 40, Phenomena of present-day emigration; § 41, Religions and languages; § 42, Classes and professions.

These are followed by seventy pages of closely packed information on economic conditions—agricultural methods and manure; crops raised and times of harvest; fruit trees and other trees; limits of cultivation and of tree and shrub-growth, etc. The thread running throughout is a comparison between the conditions in the three *Tessils* of Baltistan, Purik, and Ladakh. No short summary could do justice to this detailed investigation; it deserves careful study: yet one conclusion should be noticed. The Assessment Reports give the yield of the harvest of each product, and also the totals of the domestic animals in each *Tessil*. Professor Dainelli had made notes on the current prices of all these, and thus was able to assess the comparative wealth per head of population in terms of Italian *lire* (Tables XXXI., p. 341, and XXXIV., p. 382).

	Baltistan.	*Purik.*	*Ladakh.*
Harvest value per head (*lire*)	100	71	132
Animals „ „ „	89	103	209

Thus Ladakh, the least favourably situated owing to its greater elevation, enjoys a greater degree of prosperity (or should one say less poverty?) than either of the others. This fact the author attributes to the effects of Buddhism and polyandry, which prevent a subdivision of landed property and a rapid increase in population.

The first part of Vol. 9 treats of cultural conditions in Central Kashmir (Dainelli). Races, languages, and dialects are fully discussed in §§ 1 and 2, and the author's views are summarized in Map I. Some fifty pages, §§ 3–11, are devoted to an exhaustive description of the distinctive dress, ornaments, and general physical appearance of each of the author's six racial groups. These are profusely illustrated by photographs (Plates VI.–XIII. and LXVI.–XCII.), while the distribution of the groups is shown on Maps II. and III.

The next sixty pages, §§ 12–20, deal with the three main religions: Hindu Buddhism, Tibetan Buddhism, and Muhammadanism—their distribution in Maps IV. and V.; their introduction and origin, as indicated by many rock-sculptures and other remains, in Plates XIV.–XIX.; their influence on customs and dialects, as well as on religious and secular architecture, in Plates XIX.–XLVII. Many authorities have stated that the population is divided into castes, but Dainelli combats this statement and maintains that classes is the more correct term. He mentions specially (§ 22) the two lowest classes, *mon* (musicians) and *argon* (half-breeds), because of the theory propounded by A. H. Francke, in his 'History of Kashmir,' that these are the aborigines enslaved by their conquerors. The author proves conclusively that the *mon*

do not differ in any respect, except in poverty and occupation, from the particular racial group amongst which they live.

The last thirty pages, §§ 24–27, contain a general summary of the various arguments. After a careful review of earlier theories on the ethnical affinities of the inhabitants of Central Kashmir, Dainelli states, and seems to justify, his opinion that the whole area, including Ladakh, was originally peopled by Dards, *i.e.* Iranian. The early history is very obscure, but it seems certain that about the tenth century Ladakh was occupied by Tibetan conquerors who settled down as agriculturists, imposing their religion and language without destroying or absorbing their predecessors. The Mongolian element, thus introduced, not nearly so marked as previous observers have asserted, steadily decreases from south-east to north-west, and is quite exceptional in Baltistan. The Chang-pa are far more Mongolian than the Ladakhi, but even they show traces of Iranian blood.

Part II.—Somatic types of the inhabitants of the Upper Indus—is by Signor Biasutti. This section, pp. 181–299, is of special importance to anthropologists, for it contains a detailed technical investigation by Professor Biasutti of the usual ten anthropometric measurements and seventeen observations of each of the 408 individuals examined by Professor Dainelli at various places which he visited. A full record of all the details and of the calculated indices is given (pp. 269–299), and in the preceding text Professor Biasutti discusses at length the racial elements of each of Dainelli's groups and defines them ethnically. There seems to be no doubt that Professor Dainelli's main contentions, based on general characteristics, appearance, dress, buildings, dialects, customs, etc., are fully upheld by anthropometric considerations.

The last thirteen pages of the text (Part III.) give the results of the measurements of a Balti cranium (Plate XCIII.) obtained by Professor Dainelli at Parcutta, nor far from Skardo. These measurements are compared with those of the Nagar cranium (Plate XCIV.), described by Duckworth, and also with a considerable number of others obtained from neighbouring parts of Asia, viz. Hindu Kush, Tibet, and India. The details are too technical for the general reader, but should be of particular interest to craniologists.

B. B. D.

TECTONIC GEOLOGY AND GEOPHYSICS

Grundfragen der vergleichenden Tektonik.— H. Stille. Borntraeger, Berlin. 1924. Pp. viii. + 443. *With* 14 *Text Figures. Mk.* 24.75 *bound.*

Geotektonische Hypothesen.— F. Nölke. Borntraeger, Berlin. 1924. Pp. viii. + 128.

Gestaltungsgeschichte der Erde.— L. Kober. Borntraeger, Berlin. 1925. Pp. viii. + 200. *With* 60 *Text Figures and a Folded Chart. Mk.* 7.50 *bound.*

Der Aufbau der Erde.— B. Gutenberg. Borntraeger, Berlin. 1925. Pp. viii. + 168. *With* 23 *Text Figures. Mk.* 11.10 *bound.*

THE problems associated with earth-movements are the most difficult and baffling that geology as a physical science has to face. The great work of Suess contained a first world-synthesis, and attempted a comprehensive interpretation of all the data then available. We know to-day that his attempt was premature; but we recognize the genius that grasped the problems as a whole, laid the foundations of their growing solution, and stimulated younger men to press forward with renewed enthusiasm. The war interrupted the

flow of new publications, but the last five or six years have made good the gap by an accelerating stream of significant works. The four books before us, all issued by the Gebrüder Borntraeger, almost present a second world-synthesis; and, like that of Suess, their chief value lies in the data they summarize and the interest they arouse, rather than in the complex array of hypotheses they advocate. Suess wrote before the discovery of radioactivity. These books represent the culmination of an epoch that is negatively characterized by the failure to appreciate the significance of radioactivity. The new epoch has already begun under the leadership of Professor Joly, who has carried the implications of radioactivity to some of their logical conclusions. In future it will be as permissible to neglect gravitation as to ignore the ceaseless outpouring of energy which is everywhere taking place beneath our feet.

The most valuable feature of Dr. Stille's book is that it sets forth with admirable detail all the known facts relating to mountain-building epochs since the beginning of the Cambrian period. The structural history of Europe is clearly brought out as the successive addition to the primitive pre-Cambrian lands of the folded regions of Caledonian, Hercynian, and Alpine earth-movements. But while it is convenient in this time-honoured way to group the minor phases of orogenesis about these three great crescendoes of mountain-building, it is clear, when the evidence is stratigraphically presented, that there have been fully a score of well-defined epochs of movement since the beginning of the Cambrian. It has already been suggested that this multiplicity of phases makes it difficult to accept Joly's hypothesis, for according to the latter, each phase represents about 30 million years, the time required for a cycle of basaltic fusion and reconsolidation. However, the difficulty disappears if one accepts the estimates of time based on the disintegration of uranium and thorium in rock-forming minerals, as the period which has elapsed since the end of the pre-Cambrian is then of the order 500–600 million years. In another direction Stille unconsciously supports Joly's views, for he maintains, in opposition to Suess, that the great epeirogenetic movements have involved depressions and elevations not merely in a relative sense, but absolutely with reference to the centre of the Earth. Here we have the geological expression of alternating expansion and contraction in the substratum. In the twenty contractions that have presumably taken place in the period considered there is ample justification for Stille's continued belief in the efficacy of the contraction theory of mountain building. That theory has been proved again and again—radioactivity being ignored—to be physically inadequate. In its new form the contraction theory may yet justify the faith of those geologists who have accepted the testimony of the earth, though it seemed incredible.

Dr. Nölke is also of the faithful. His interesting book is in part a critical analysis of fourteen different hypotheses (not including Joly's) which have been advocated to account for the origin of geotectonic forces. He concludes that the crustal-contraction theory emerges as the only one that is adequate to account for the geological facts. No thermal or other hypothesis is adopted in order to calculate how much contraction can have taken place. Instead, the sounder method is applied of estimating the contraction that is implied by the rock-structures. The estimate of circumferential shortening during the mountain-building of Tertiary times alone amounts to 1200 km., apparently corresponding to a radial shrinkage of 200 km. This estimate is probably much too high, for it seems impossible that any great circle of the Earth can have shrunk by four times the shortening represented by the overthrusts of the Alps (about 300 km.). But even admitting Nölke's incredible maximum,

there is no real necessity to assume an ultimate radial contraction of 200 km. Tension, as Dr. J. W. Evans has recently demonstrated, has also been a widespread condition of the crust, and surely it implies expansion. If then we have alternating contraction and expansion, with the tension clefts filled and healed by magmatic injections from below, it becomes possible to envisage an earth heaving about a mean radius while the effects of successive contractions steadily accumulate. Joly's theory thus meets the requirements of the contraction hypothesis, allows equally well for tension, and avoids many of the difficulties that have always beset the contraction hypothesis in its older forms.

Prof. Kober is already well known for his theory of orogeny as expressed in 'Der Bau der Erde,' 1921. In his new and shorter book he presents the theory afresh, and summarizes simply, and with a wealth of effective illustration, the tectonic history of the Earth, and the structural features of its chief geographical divisions. Kober recognizes two sets of structural units: (*a*) the broad and rigid continental shields, and (*b*) the mobile belts of unstable geosynclines and sinking oceanic areas. The motive force of orogenesis he finds, like our other writers, in contraction. As the geosynclines are filled with sediments and subside they become squeezed between the adjacent shields or forelands as the latter press together in response to the shrinkage of the Earth. Thus there arises an *orogen*, or fan-shaped wedge, on either side of which folded and overthrust mountains develop as the deformation proceeds. The overfolds and recumbent sheets or *Decken* are squeezed over the subterranean parts of the rigid forelands, and the mountain chains thus tend ideally to constitute a bilateral system. Thus the Alps, with the Pyrenees, the Carpathians, and the Caucasus, are thrust to the north, while the Atlas, Apennines, Dinaric, Tauric, and Iranian ranges are overturned towards the southern foreland, part of which is apparently the Adriatic Sea. The Cordillera of North America constitutes another complete *orogen* with the Pacific ranges on the west, the Rocky Mountains on the east, and the interior plains between. In the Appalachian and Caledonian systems the *orogen* are incomplete, half having in each case foundered into the Atlantic. The book is an excellent contribution to the literature of physical geography as well as to that of tectonic geology and petrology. Although it is written in quite easy German a translation into English would undoubtedly be widely appreciated.

Dr. Gutenberg's book differs widely from the others under review. It presents an authoritative summary of all the geophysical evidence so far collected with reference to the structure of the Earth. Dr. Gutenberg has himself made substantial contributions to the development of seismology, and consequently the part of the book which is devoted to this branch of geophysics is the most valuable. The first chapter gives a clear and first-hand account of the interpretation of earthquake waves, well illustrated with figures showing typical seismograms for different epicentral distances. Attention is directed, for the first time in a text-book, to the work of A. and S. Mohorovičić on the compressional waves within the outer layers. The velocities of these surface waves confirm the general opinion that the outer continental crust is of essentially granitic composition to a considerable depth, though the evidence is, as yet, not sufficiently delicate to indicate actual thicknesses at different places. For greater depths Gutenberg confirms Dr. R. D. Oldham's conclusion that the velocity of the compressional waves begins to decrease at a depth of about 0·6 of the radius. Distortional waves are not detectable at distances greater than 140° from the epicentrum, suggesting that the core of the Earth is in a fluid condition.

The form and density of the Earth are well discussed with special reference to recent papers from the Carnegie Institution of Washington. Temperature distribution is also adequately dealt with, and the importance of radioactivity is fully appreciated. Unfortunately, the book appears to have been published too soon to do justice to Prof. Joly's inspiring conception of the basaltic cycle of fusion and consolidation. One brief sentence reveals the author's acquaintance with Joly's 1923 papers, but no discussion or criticism is offered. Other chapters worthy of special notice deal with the composition of the Earth and the structure of the atmosphere.

The book concludes with a general summary. No final conclusions are advocated, for the object is not so much to present a particular point of view as to give a general survey of ascertained knowledge. A great deal of widely scattered information is compressed into a very compact form, especially by the insertion of tables of numerical data. The bibliography, which is an adequate guide to the literature up to 1924, is a feature for which all geophysicists will be grateful, for in the past, and partly as a result of the war, it has been almost impossible to keep in touch with all the work, much of it excellent, that has been published in various corners of Europe.

It is strikingly clear from all these books that something is missing. European geologists have begun to take their courage in their hands, and to believe in the evidence of the rocks, even though their faith suggested physical impossibilities. The multiplicity of hypotheses is, however, a depressing proof that they have not yet thoroughly justified their faith, nor captured as yet the elusive truth for which they strive. It is the reviewer's belief that Prof. Joly* has supplied the missing link, and that only when the radioactivity of the rocks is added to the other physical conditions involved will an adequate foundation to a sound tectonic theory be well and truly laid.

ARTHUR HOLMES.

REVIEWS

EUROPE

Spanish Towns and People.— Robert Medill McBride. London: T. Fisher Unwin. 1926. 9½ × 6½, pp. xiv. + 246. *Sketch-maps and Illustrations.* 15*s. net.*

GENEROUS margins to its pages of beautiful type account for more than half of this handsome volume, which consists, for the rest, of history of the usual guide-book kind, interspersed with an American traveller's reactions to Spain as he saw it during a brief August tour.

Early in the book we read with a silent wonder that Mr. McBride actually *chose* August for his tour because he wished to see "the harvest in full swing, . . . the shepherds tending their flocks," etc.; the full passage, which will be found on page 13, might be usefully set by examiners for the criticism of examinees. So we are not astonished when we see later that the Spaniard has "no knowledge of sport and little interest in active outdoor life," because we read this statement, like many others, with the tacit reservation—in August.

The same reservation accounts, no doubt, for a certain irritating recurrence of phrases which makes so many of Mr. McBride's descriptions monotonous. The August climate does, after all, obliterate a good many distinctions.

* 'The Surface History of the Earth,' 1925. See also *Geogr. Journ.*, June 1925, p. 528.

Where it does not, in Segovia and Avila for example, the chapters have freshness and vividness, qualities which seem to be smothered elsewhere by the August dust. Occasionally a phrase leaps out even from the dust; thus in the south-west the towns and villages "gleamed like Cyclopean drifts of snow in the brilliant sun"; and there were grapes in the market at Seville "as green as glacial water." But on the whole the author is more successful with his draughtsmanship—we get a clear idea of the immediate, though not of the general, situation of his towns—than with his colour. Besides, the colour runs rather badly into the history.

Not that Mr. McBride is an unobservant tourist; he probably saw most of what was to be seen—in August. He quickly grasped the fact that the physical analogues of the arid interior of the Peninsula are to be found in the interior of North America, and this is to be counted to him for righteousness, and unusual righteousness too. There was also beginning to dawn in his mind an appreciation of that spirit which is something more than mere blind continuance of mediæval traditions, and which, projected into the New World, stands out against what we may call loosely the spirit of North America in one of the most interesting and important antitheses of modern times. It is not easy to capture and define this spirit in Spain herself; it is less easy to disentangle it from indigenous elements in the various cultures of the New World. Yet the true inwardness of one of the principal international problems of to-day lies here.

Mr. McBride however does not try to capture and define the spirit of Spain. He had only glimpses of it, shrewd glimpses for a hurrying tourist, when he sensed an atmosphere in Spain inimical to the large store, when he saw individualism flourishing everywhere and expressing itself as specialism in retail trade, and when he watched in the markets the direct dealings of the public in essential supplies. Probably some vague generalizations springing from these observations explain the nebulous summing-up of his closing page: "Spain is a magic land, where yesterday and to-day meet and mingle in harmony, defying time."

Two sentences call for special comment: "in this ribbon of fertility, groves of olives, almonds, and figs, with flourishing vineyards, give evidence of a *pastoral life*," on page 216; and "Aragon, which gave *Isabella* to Spain" (this is "Tanto monta" with a vengeance), on page 217. These are not mere misprints, they are cardinal errors. R. A.

Concerning Corsica.— **Réné Juta.** London: John Lane. 1926. 7½ × 5, pp. xvi. + 198. 8 *Illustrations in colour by* **Jan Juta.** 10*s.* 6*d. net.*

To those who seek an inexpensive holiday in a beautiful but little-known island that is not overrun by tourists, yet is within a few hours' steam of Marseilles or Nice, Corsica may be recommended; and if they read Miss Réné Juta's refreshing little book before they go, they will gain a very good idea of the delights that await them in those mediæval citadels and on the sweetest-scented hillsides in the world. Miss Juta was but a passer-by, but this account of her experiences has all the freshness that first impressions make upon a mind sensitive to atmosphere and quick in observation. There is no flavour of the guide-book about her descriptions. Take this little picture of that "fairy-tale town," Bonifacio: "Through a narrow passage in chalk cliffs, you come suddenly upon this high town with the low water-edged *marina* at its base. From here it is compact, walled: a port. From the sea it is a city, towering out of rock: tall towering houses of defence, gathered

like a cohort, glistening, watching the seas; high houses with Genoese balconies at rare intervals, and sweeping vaults, and arches spanning narrow streets and linking all into a complete design. It is an archive of the Middle Ages."

When she comes to cold facts, Miss Juta is not always so happy. With the changing value of the franc the prices she quotes are not to be relied upon. She remarks that at Piana the sea is so far below that bathing or fishing is not possible, whereas the sandy fishing cove, lying but an hour's walk down the valley along a mule track, is a favourite expedition for visitors. And it must be noted that the birthplace of Paoli was Morosaglia, not Corte. These and other slight flaws do not, however, seriously detract from the charm of a delightfully written book. O. R.

A Wayfarer in Alsace.— B. S. Townroe. London: Methuen. 1926. $7\frac{1}{2} \times 5$, pp. xii. + 211. *Illustrations.* 7*s.* 6*d. net.*

On his journeys through Alsace Mr. Townroe seems to have been mainly interested in the political situation. His first concern was to discover whether the Alsatians preferred the new régime to the pre-war conditions of affairs, and to study recent economic and social developments. As he also devotes space to the historical and legendary associations of the country-side, he has only limited opportunities to deal with the subject from the more practical point of view of the traveller. This is perhaps an advantage. His aim is to induce others to travel in Alsace, and the best way to do this is to make them thoroughly interested in its people. In this he succeeds admirably. No one could read his book without wishing to make their acquaintance at the first opportunity. His sketch of the country and its people is faithful and in general impartial. As a holiday ground Alsace is happy in the possession of two attractions, the hillsides, forests, and villages of the Vosges, and the cities and towns of the plain, specially rich, as Mr. Townroe points out, in buildings of architectural interest with an individuality of their own. Sometimes, as in the chapters on Strasbourg, the author's interests prevent him from doing full justice to this aspect, but the reader will readily forgive this for his very sympathetic and interesting sketch of the vicissitudes of Alsace's story.

A Student in Sicily.— N. Jackson. London: John Lane. 1926. $7\frac{1}{2} \times 5$, pp. xx. + 258. *Sketch-map and Illustrations.* 12*s.* 6*d. net.*

A sketch of scenes and ancient buildings seen in a tour of the island, through Messina, Palermo, Girgenti, Castrogiovanni, Syracuse, Taormina, and the country round Etna, with historical references, remarks on the architecture, and sidelights on the peasantry, form the first part of this book. In the second part the artistic tastes and antiquarian knowledge of the authoress are shown in her descriptions of jewellery, enamels, amber and coins, lace and embroidery, wood-carving, pottery and glass. There is added a bright account of the gardens of Sicily. The charm of their arrangement and situation, the variety, colour and massing of the flowers, the grateful shade of the well-placed trees are described with an enthusiasm that can hardly fail to excite the attention and interest of the reader. In view of the contention that a flower garden in the modern sense of the word was a thing unknown in classical times, that, in fact, the first real flower garden in Europe was the little botanical garden at Padua, planted in the sixteenth century, it would be interesting to know how far back cultivated flowers were grown in these Sicilian gardens. Mrs. Jackson has evidently found in the scenery, architecture, antiquities and people of

Sicily a thoroughly sympathetic field, and while her story will be a revelation to her readers who are unacquainted with the island, it contains much that will be of interest to those who have already visited it. The book is well illustrated with eight coloured plates and sixty-five photographs. E. A. P.

Francis Mortoft: His Book; Being His Travels through France and Italy, 1658–9.— Edited by Malcolm Letts. London: Printed for the Hakluyt Society. 1925. 9 × 6, pp. xxxiv. + 216. *Maps and Illustration. Issued to Members only.*

This book is a distinct addition to our library of seventeenth-century travel. Quite apart from its own interests, Mr. Letts' editing, which is a model of scholarly care, will make it a standard work of reference for future labourers in this field. Mortoft is a conscientious young gentleman who knows that he has been sent abroad for improvement, and he duly records in detail the results of each day's sight-seeing. He has little to say of the country or of the people, but such observations as he gives us—the accounts of Queen Christina of Sweden, for instance—are good enough and quaint enough to make us wish there were more. His route was not the usual one. In France he went from Paris to Orleans, Nantes, Bordeaux, Toulouse, and Arles, thus seeing more of the country than most travellers. Instead of taking boat from Antibes for Genoa he faced all the difficulties of the coast road. In Italy he followed more or less the beaten track. Rome he saw with great thoroughness. However, he did not spend Easter there, like most people, but at Venice, which travellers usually preferred to visit for the Ascension Day Fair and the Wedding of the Sea. Probably his time was limited. He was a true son of his age in his tastes. The ancient world was his main interest and, like most people without much artistic training, he finds it easier to appreciate sculpture than painting, where he obviously feels that he is on slippery ground, though his praise is rarely perfunctory. He has the seventeenth-century Englishman's passion for music. He returns again and again to the Chiese Nuova, where was probably then the best music in the world, though we could not imagine him revisiting a gallery, and he never fails to record his keen appreciation of what he heard there and elsewhere. L. C.-M.

Modern Turkey.— Eliot Grinnel Mears. New York: The Macmillan Co. 1925. 9 × 6, pp. xiv. + 780. *Maps and Illustrations.* 25*s.* net.

Turkey in Travail.— Harold Armstrong. London: John Lane. 1925. 7½ × 5, pp. xii. + 280. *Sketch-maps and Illustrations.* 8*s.* 6*d. net.*

The first book is of marked importance, and it must be studied by all those interested in Turkey and the Near East, because of the obvious knowledge possessed by the principal writer about the subject with which he deals, and of the careful way in which he has performed his task. Indeed, as Admiral Mark Bristol, the American High Commissioner at Constantinople, says in his Foreword, the author has realized, after months of residence in Constantinople as a Government official, the necessity for a volume giving up-to-date practical information regarding Turkey; and his experiences in that country and in Greece, with his work in the Caucasus and Armenia, have given him a perspective and an insight into the situation at first hand. It will be particularly gratifying to the British reader that Mr. Mears has adopted the British system of spelling, and he has rightly committed himself to the pronouncements of the P.C.G.N. upon the subject of proper names.

Defining "Modern Turkey" as commencing in 1908, Mr. Mears has

selected subjects of far-reaching significance and assigned a discussion of some of them to representative authorities, all of whom have been to, and most of whom have lived in, Turkey. A number of Turks have contributed to the volume, and such questions as "Women," "The Turkish Press," and "International Relations" are treated by Dr. Patrick, the former President of the Constantinople Woman's College, who probably knows more about the subject than anybody else; by Ahmed Emin Bey, a distinguished Turkish journalist with an American degree; and by Mr. Albert Putney, an American who has written a number of books and held a high appointment in the State Department at Washington. But this system of contribution raised an obvious difficulty, since many of the chapters were received some time in advance of their actual publication; and, in order to overcome this, Mr. Mears has written special introductions to the various articles, in which he provides subsequent information and furthers the unity of the book.

Such a work, equipped with numerous illustrations and with six maps, cannot be reviewed in detail here. All that is possible to say, therefore, is that the general text, which runs to 575 pages, the full Chronology of Events from 1908 to 1923, and the inclusion of what are called a series of "Select Documents," bearing upon the epoch in question, must make "Modern Turkey" a highly valuable contribution to our knowledge upon the subject—a contribution necessary of perusal by all those desirous of knowing what has taken place during the last eighteen eventful years.

Major Armstrong's book is of a different class from Mr. Mears', recording the impressions of a British officer who was captured at Kut, imprisoned in Turkey, and later on employed there during the years of the international occupation which followed the Armistice. Thus the author, who proves himself an observant man, has had opportunities of seeing the Ottoman Empire at a time when the Turks and their German Allies appeared to be victorious; of studying conditions at a moment when the Sultan, his advisers, and his people could have had almost any terms imposed upon them; and of witnessing what was really the ignominious departure of the Allied troops when Mustapha Kemal Pasha and his Nationalist colleagues had re-established a position for themselves under the Treaty of Lausanne. But besides a very readable and attractive account of the author's own experiences, we are given a great deal of information about people and things in the East.

Major Armstrong was imprisoned at Kastamuni, at Constantinople, and at Afiun-Qarahisar. Finally, when plans had been made for escape—plans doomed to failure—orders came for an exchange of sick prisoners, and with a little financial arrangement the author was put on the train for Smyrna. Here he heard of the Bulgarian capitulation, on his way across Europe he learned that the Germans had signed the Armistice, and by the middle of December 1918 he was employed at the War Office. Four months later Major Armstrong returned to the East, where he served as Assistant Military Attaché at Constantinople and as a gendarmerie control officer, and later on as one of the officials detailed to count and to catalogue the stores, ammunition, and arms which existed in Turkey at a time when endeavours were being made to enforce the Treaty of Sèvres.

Altogether, Major Armstrong's book is an interesting, helpful, and instructive addition to our knowledge of people and things in Turkey.

H. C. W.

Modern Europe and its Beginnings.— **E. H. McNeal.** New York: Charles Scribner's Sons. 1925. $7\frac{1}{2} \times 5$, pp. xviii. + 514. *Sketch-maps and Illustrations.* 10*s.* 6*d. net.*

It would be ungrateful to Professor McNeal to commence a notice of his work without a reference to the success of his attempt to reduce the history of Europe into a small compass. How widely he has interpreted his task is seen when it is realized that for him the beginnings of modern Europe are to be found in the valleys of the Euphrates and Nile. Yet he has succeeded in sketching history from those beginnings to the French Revolution within the first half of his book. As his scope includes art, literature, and science in so far as they bear upon historical developments, he could not be expected to satisfy all interests. In these circumstances it is something that geographical factors have not been entirely ignored, *e.g.* there are brief remarks upon the *rôle* played by the Alps, on the influence of trade routes, and on the great age of geographical discovery. In his sketch of British constitutional history, exception might perhaps be taken to the statements that the rights of Parliament were founded upon custom and law reaching back to the thirteenth century, and that the Governor-General of a Dominion exercises no constitutional powers; but these are probably the results of condensation. The United Provinces are referred to throughout as the United Netherlands. The sketch-maps in the text seem unnecessarily crude, and the physical map at the end is hardly adequate. It is a hopeful sign that text-books dealing so sympathetically and informingly with European history should be appearing in the United States. G. R. C.

ASIA

Courts and Camps in India: Impressions of Viceregal Tours, 1921–1924.— **Yvonne Fitzroy.** London: Methuen & Co. 1926. $9 \times 5\frac{1}{2}$, pp. xi. + 243. *Twenty-seven Illustrations.* 16*s. net.*

This book presents a record of experiences and impressions during four crowded years of life as a member of the viceregal household in India. We have picturesque sketches of Kashmir and of the lands of Rajput chivalry; of Delhi, Agra, Mandu, Lucknow, Calcutta, and the marvels of Ellora and Ajanta; of progressive Mysore, with a graphic description of an elephant khedda; and last, but by no means least, a shrewd and just picture of life in the summer capital. It must not be regarded as a handbook for tourists; and the historian will question certain items of information, no doubt supplied by local guides. Things are not ordinarily seen in their true perspective from the Viceroy's *entourage;* but Miss Fitzroy is no ordinary observer: she reveals not only a truly artistic temperament that can revel in the charms of nature's wide canvases, and a refined humour that can be diverted by the comedies of life in a narrow and essentially official *milieu*, but also a clearness of intellectual vision that can pick out the salient features as well of a building or landscape as of the political and administrative problems of that absorbingly interesting land. Certain paragraphs in Miss Fitzroy's book show more sagacity than many volumes written by touring politicians. Indeed, many who have spent their lives in India will close it with a sense of regret that more Englishwomen of this type, so well fitted to appreciate "the little matters of courtesy to the greater matters of sympathy and understanding" (p. 213), had not devoted themselves to that country. C. E. A. W. O.

Roving through Southern China.— **H. A. Franck.** London: T. Fisher Unwin. 1926. 9½ × 6½, pp. xxii. + 650. *Map and Illustrations.* 25*s. net.*

Having published, two years ago, an account of his wanderings in Northern China, Mr. Franck now supplements it by describing his journeying through the Southern provinces. He shows the same energy, powers of observation and unconventional expression as in his preceding books of travel. This book is all the more interesting in that it gives some first-hand information and sensible criticism regarding the present disturbed state of the country which is causing so much concern in Western Europe. His account of the conditions existing in Canton, where he resided for some time, is peculiarly *à propos* at the present moment. His reflections on the social and religious character of the people, and the part being played by Western Missions, are judicious and far-sighted, and well worthy of attention. The pleasure of reading his narrative is not enhanced, however, by the constant reference to the dirt, squalor, and absence of sanitation which he notices on almost every occasion. Observations less superficial, penetrating a little more into the inner life of the people, especially those of the better class, would have been welcome. Of the coolies whom he had continually to employ as bearers, he gives a full and informing picture: their hard labour, patience, and good humour are constantly in evidence.

The extent of the author's wanderings was certainly considerable. Starting from Shanghai on the east coast, he reached the summit of the sacred mountain of Omeishan, 11,000 feet high, in the extreme west, almost overlooking the Tibetan frontier. After making a circular tour inland from Shanghai, during which he visited the most famous pottery town in the world, Kingtehchen, he made his way along the south coast, visiting Amoy, Swatow, Hongkong, Canton, and Hainan, to Hanoi in Tongking. Thence he wandered north through Yünnan province to Yünnanfu and Suchan, getting glimpses on the way of some of China's uncivilized tribes, the Lolos and Miaos. From Suchan he penetrated some distance into Szechwan, and after climbing Omeishan, descended the Yangtze Kiang through the gorges to Hangchow, whence he finished his journeyings by going across country to Canton.

The numerous excellent photographs taken by the author well deserve the title he gives them of unusual—for it would be difficult to find most of them elsewhere. They are exceedingly interesting, and will greatly help the reader to visualize the people and scenes he describes. Unfortunately, the single map provided does not come up to the same standard. It is a pity more attention was not given to this so that the reader could more easily follow in detail the traveller's route. Neither the railways nor many of the places mentioned are to be found on the map. There is no index. E. A. P.

AFRICA

The Dwellers on the Nile.— **E. A. W. Budge.** London: R.T.S. 1926. 8½ × 5½, pp. xxxii. × 326. *Illustrations.* 10*s.* 6*d. net.*

As long ago as 1885 Sir Wallis Budge wrote a little book for the Religious Tract Society, entitled 'Dwellers on the Nile.' The present is a completely rewritten work on the same subject, rewritten in the light of the many important archæological discoveries made during the last forty years. After a brief historical synopsis and a list of the kings, the life of the Ancient Egyptians is described in a series of chapters on the Family and Home, the House and

Food, the Pharaohs and their subjects, Work and Play, Writing, Wisdom, Literature, and Religion. In his descriptions the author frequently interpolates the hieroglyphics for words and phrases. The book is well printed, but on very thick paper, which makes it rather a clumsy volume to handle. On thin paper it would be reduced to half its size and made much more handy and convenient to hold, which for a work avowedly popular would be a great advantage. It is illustrated with 11 plates and 38 drawings in the text. It may seem perhaps ungrateful to complain of their fewness, yet for a popular work more illustrations of the many objects in constant use by the Ancient Egyptians mentioned in the text, more after the manner of Wilkinson's famous popular abridgement, would have undoubtedly made it more attractive and intesting to the general reader. A short bibliography is added, and there is a good index. E. A. P.

Adventures of Exploration.— Sir J. Scott Keltie and S. C. Gilmour. Book IV, Africa. London: G. Philip & Son. 1926. 7½ × 5, pp. 180. *Maps and Illustrations.* 2*s*.

The publication of the fourth volume of this striking series of Geographical Readers calls for some addition to the notice of the first three given in the *Journal* last year (vol. **66**, p. 373). It deals with the fascinating story, not only of the African voyages of the early Portuguese and other navigators, but also of the adventures of the great explorers whose successive struggles gradually let in increasing light upon the unknown inner regions of the Dark Continent. It is a work which should prove of the deepest interest to British readers of all ages. Indeed, it is within the knowledge of the present writer that volumes already published claim the enthusiasm of such, alike of seven and seventy years! This is as it should be, for no fewer than eight of the fourteen chapters before us are, justly, devoted to the exploits of men of our own kith and kin. These range from James Bruce to Samuel Baker, and from Livingstone to Selous, and to them must be added Stanley's story of how he found "Doctor Livingstone, I presume"!

The value of the book is by no means confined to the actual information it conveys as to the various stages of the opening up of the unknown. It consists still more in the spiritual value of the achievements of men inspired with worthy aims, and ready, at all costs, to persevere in the tasks they had set before them. One closes such a volume, brief though it is, with the conviction that no lad of British blood capable of reading it would be worth his salt who failed to be stirred and stimulated by stories of courage and determination in the face of almost insuperable obstacles, such as are here recounted, displayed by men of the race to which he himself belongs. Such a work as this stands out in vivid contrast to the style of those referred to by the late Prof. Green, in the introduction to his 'Short Geography of the British Islands,' quoted by Sir John Keltie in the "Report on Geographical Education" drawn up by him for the Council of the Royal Geographical Society in 1885. Very feelingly he observes that "No drearier task can be set for the worst of criminals than that of studying a set of geographical textbooks such as the children in our own schools are doomed to use"! Elsewhere in the same Report it is remarked that "Some publishers seem to think that the more eccentric their maps are, the more claim they have to originality and utility."

To such characteristics as these, the Readers now under review offer an exact antithesis. Apart from the style and the subject-matter in the text

itself, each separate chapter is supplied with its own special map, beautifully clear and concise, to illustrate the particular routes and events it describes. This is an admirable feature, as it obviates the confusion so often caused in the younger minds by the overcrowding of names. W. W.

Among the Bantu Nomads.— J. Tom Brown. London: Seeley, Service & Co., Ltd. 1926. 8¾ × 5½, pp. 272. *Illustrations and a Map.* 21*s. net.*

The inadequacy of our information concerning the native peoples of the southern parts of Africa is demonstrative of the fact that the white man has too often failed to interest himself in native customs until they are threatened with decay. As Prof. Radcliffe Brown points out in his introduction to this book, it is the missionaries who have collected the greater part of the available information on the ethnology of South Africa, and the author, who died before it was issued, had in this capacity spent nearly forty years amongst the tribes he describes. We may suppose that he could have made a bigger book of it, and that there must be other and more detailed records of his making—and, indeed, he did valuable work in linguistics—but we must be thankful for what we receive.

The Bechuana form the subject of the book, and there is an interesting account of the various tribes—the Barolong, Batlhaping, Bakaa, Bamangwato, and others—and of their history and relationships. Of the many subjects discussed we may note Totemism, Family Life and Kinship, Marriage Laws and Customs, Childhood, Adolescence, Burial, Religious Beliefs and Customs, Mythology and Folklore. On all these matters Mr. Brown wrote with first-hand knowledge, and he was too tolerant to condemn many things that were outside the range of his sympathies. Ethnologists will find the book of considerable value, and will follow with interest the author's account of father-right, cross-cousin marriage, initiation, the supreme being, and much else. Here and there Egyptian influence comes into the picture, which by some will be the more admired on that account.

The illustrations are half-tone reproductions of good photographs of scenes and tribal types, and they are interesting without being representative of the contents of the book. H. S. H.

AMERICA

La Découverte de l'Amérique par les Normands vers l'an 1000.— Lieut.-Colonel Langlois. Paris: Société d'éditions géographiques, maritimes et coloniales. [1924.] 10½ × 6½, pp. viii. + 164.

In the controversy which has been carried on upon the subject of the Norse voyages to America, French authors have hitherto played little or no part. "Les Sagas du Vinland," says Colonel Langlois, "n'ont jamais, à ma connaissance, été publiées *in extenso* en français." The translation of the Icelandic sources given in this book will therefore, no doubt, be specially welcome to the author's compatriots.

Colonel Langlois divides his work into three parts. Beginning with a brief excursus upon the sagas and upon the life and habits of the early Norsemen, he allots Part 2 to his translation, and finally approaches, in Part 3, the consideration of the much-discussed and probably insoluble problem of the identity of the regions visited. In his study of this question he appears to attach most importance to the works of Hovgaard and Fossum, especially the latter, while he rather surprisingly passes over the 'Studier

over Vinlandsreiserne' of Gustav Storm, which, even if in some respects superseded by later works, remains one of the most scholarly and important treatises on the subject. We have discovered but one passing reference to this author in the text, while in the bibliography, which mentions the absurd and extravagant Horsford, the name of Storm is not to be found. In the choice of points in the narrative on which to base his conclusions, Colonel Langlois shows an originality which exemplifies in a marked degree the differences of opinion which can exist on the subject. The passage about the bearing of the sun before it sets on the shortest day, which most authorities, however they may interpret it, have considered as crucial, is dismissed as useless by Colonel Langlois in a short paragraph, which seems to disclose an imperfect knowledge of much that has recently been written on the point. Similarly, the author thinks that the limits of growth of the wild vine have no bearing upon his subject, though the vines which gave the land its name are surely among the most conclusively established points in the narrative. Their existence was a point which had come to the notice of Adam of Bremen in the eleventh century, while further corroboration is afforded by the apparently contemporary verses of Thorhall the Hunter, incorporated in the saga. To the topographical descriptions, particularly to the very remarkable and suggestive feature of the "Furdustrandir," or long sandy beaches, Colonel Langlois pays equally little attention. He pins his faith, so he tells us, mainly to the courses given in the sagas, which are in any case vague and approximate, inconsistent in the different sources, and not beyond the suspicion of having been altered in some cases by careless copyists. To show how opinions can differ, we may quote the opinion of another recent student of the question—"the courses on the whole are so manifestly wrong, or at best vague approximations, that no one can be on sure ground who relies on them."

Coming to results, Colonel Langlois is inclined to place the Vinland of Leif in the St. Lawrence, and the Hóp of Karlsefni on the south-east coast of Newfoundland. Further south he dares not go, since it would involve "des pays déja très chauds en été, des arbres inconnus," etc. This reasoning is rather curious, when we recall that unknown trees and a mild climate are actually prominent features in the story. The author concludes, however, with a wise caution against dogmatizing on a subject on which so much uncertainty necessarily must prevail. On this point, all students of the question will no doubt agree with him. G. M. G.-H.

New York City : A Guide Book for Travellers.— Edited by **Fremont Rider.** London: George Allen & Unwin, Ltd. 1924. 7 × 5, pp. 670. 13 *Maps and* 20 *Plans.* 17*s.* 6*d. net.*

The contents of this volume of "Rider's Guides" include information regarding hotels, shops, galleries, theatres, etc., in New York, the city being dealt with section by section, as Downtown, Uptown, the Bronx, Brooklyn, and Staten Island. It no doubt serves as a useful aid to those courageous and optimistic persons who visit New York with a view to sight-seeing. The maps, although poorly printed, appear to be adequate, and there is a good index.

In the same series are published Rider's 'Washington,' 548 pages (10*s.* 6*d.*), a smaller volume on similar lines, but with more interesting historical notes; and 'Bermuda,' 158 pages (7*s.* 6*d.*), still slimmer, and composed of decidedly more attractive material; but it needs bringing up to

date, for the editing dates back to 1922, since when much water has flowed under Bermuda bridges. The type, paper, and proof-reading of the series are open to criticism.

A Tropical Tramp with the Tourists.— Harry L. Foster. London: John Lane. 1925. 8 × 5½, pp. 335. *Illustrations.* 12*s.* 6*d.* net.

Mr. Foster is a determinedly facetious traveller, and while writing on the occasion of his adventures, in a luxurious steamer with a party of Americans in place of by-paths as before, he has again taken South America as his theme. One has become accustomed of late to encounter masses of tourists, propelled by guides from port to port all over the world, and is scarcely surprised to find that Mr. Foster describes them as chiefly engaged in grumbling, gossiping, and drinking. The result, so far as book-making is concerned, is banal. The reader will look in vain for reliable information or illuminating comment concerning the fringes of South America hastily visited. The illustrations are indifferent.

Las Historias del Origen de los Indios de esta Provincia de Guatemala, traducidas de la Lengua Quiché al Castellano . . . por el R. P. F. Francisco Ximenez . . . Con una Introduccion y anotaciones por **Dr. C. Scherzer.** Salvador City, Central America. Ediciones de la Biblioteca National. 1926. 9 × 6, pp. xvi. + 136.

In this little paper-covered volume is contained practically all that is known of the religious traditions and myths of the Maya Quiché folk of Central America. The Spanish version of these queer tales of ancient gods was made, from an original Quiché text, by the Dominican missionary, Father Francisco Ximenez, for many years parish priest of the Indian town of Chichicastenango, in the Guatemalan highlands. Author of a history of Chiapas and Guatemala, written about 1721, Father Ximenez was conversant with the Quiché branch of the Maya language, and recorded from the confidences of his parishioners material that might otherwise have been irretrievably lost.

Until 1856 the works of Ximenez remained in manuscript in the city of Guatemala. They were then rescued from decay, and transcribed and published (in Vienna) by the Austrian savant Scherzer, in 1857; and the present publication is a reprint of Ximenez' translation of the legends of the Quiché, together with certain historical notes. The Dominican's object in setting down the old tales in Spanish was to guide his missionary colleagues, and for this reason the relation is simple, unencumbered, and straightforward. The President of El Salvador has been well inspired to reprint the work, of unusual interest to all students of Central America, since copies of the Vienna publication are rare. A French version of the Quiché text used by Father Ximenez was published (parallel with a transcription of the original) by Brasseur de Bourbourg in 1860, but there is no English translation.

The legends are of great interest, beginning with a creation myth and proceeding to the Quiché stories of ancestor-deities—fantastic tales of ball-games in the underworld, of the first three men, their Song of the Dawn, their disappearance, of the mysterious bundle "Veiled Majesty," of sorcery and tricks—and to the period when tribal history began with its definite tales of disputes and migrations. The commentaries of Father Ximenez, that form the second part of the volume, throw valuable light upon the customs of the Quiché, in spite of the fact that he wrote two hundred years after the Spanish

L. E. E.

AUSTRALASIA AND PACIFIC ISLANDS

A Walk about in Australia.— **Philippa Bridges.** With a Foreword by **Lieut.-General Sir Tom Bridges.** London: Hodder and Stoughton, Ltd. [1926.] 9 × 5½, pp. xiv. + 238. *Illustrations.* 16*s. net.*

This is an agreeably written account of Miss Philippa Bridges' travels in Australia, Papua, and neighbouring islands. It is a book which does not profess to contribute to geographical knowledge, nor did the author encounter any desperate adventures; but it is well worth reading as a good-humoured, unaffected narrative of journeys off the beaten track, often undertaken on foot. For Miss Bridges apparently prefers walking to all other methods of travel. Whilst in Papua she tramped across the island from Port Moresby to Buna, on the north coast, a trip which entailed crossing the Owen Stanley range, and had never previously been undertaken by a woman. In Australia she made a far more ambitious expedition, crossing the continent from Adelaide to Port Darwin. Only two women had done this before her, and these had motored with their husbands. Miss Bridges went alone, save for a native boy and his wife, and for 650 miles relied on camel transport. Her first stage was from Adelaide to Oodnadatta, a distance of 686 miles, which she covered in thirty-six hours by the fortnightly mail train. Thence to Tennant's Creek, *viâ* Alice Springs, with a string of four camels; on for over 400 miles to Powell's Creek and Emungalen on horseback and by buggy, and then 200 miles by train to the coast.

As the Governor of South Australia, Sir Tom Bridges, mentions in his Foreword, the discouragements and difficulties Miss Bridges had to face on this journey were more real than they are allowed to appear in the narrative, which is written with a restraint that is indeed more effective than pages of purple patches; but Miss Bridges pays many well-deserved tributes to the settlers she found sparsely scattered over the Great Lone Land—kindly, hospitable and warm-hearted loyalists, with the ideal of Empire ever before them.

The book is furnished with an index, but there is no map, the year of publication is not given, and some of the photographs are so indistinct as to have been scarcely worth reproducing. O. R.

POLAR REGIONS

The Saga of a Supercargo.— **F. Waldo.** Philadelphia: Macrae Smith Co. 1926. 8½ × 6½, pp. 309. *Illustrations and a Map.* $3.

The writer of this book made a voyage in a Norwegian tramp steamer from Philadelphia to Greenland and back. Such a voyage, as he says, is unusual, but a description of uneventful days and the usual ship's company on a tramp steamer, which occupy many pages, would not alone justify a volume the real interest of which lies in the account of the cryolite mines of Ivigtut in Greenland, which are almost unique. Not much has been written in English about these except Mr. S. H. Ball's article in *Meddelelser om Grönland*, vol. 63. Cryolite, which is used as a solvent with bauxite in the production of aluminium and in the manufacture of opalescent glass, is a fluoride of sodium and aluminium. It is very rare, and practically the whole of the world's supply comes from Greenland. The only other (and far inferior) deposits are in Western Siberia and Colorado. The annual output from Ivigtut seems to be about 14,000 tons, which goes partly to America and partly to Denmark. The Eskimo used the mineral ages ago to weight their fish nets, but it was first

examined in 1806 by Sir Charles Giesecke, and not worked by Europeans till 1855. The mine is a deep open cut from the face of which the mineral is blasted. Only Danish workmen are employed, and they form the sole inhabitants of the village of Ivigtut, 12 miles from the Danish trading station of Arsuk on Arsuk fjord. It is a risky task to swing on a rope over the face of the cut to drill holes for the blast, but the service, with its high pay, proves attractive, and there is no dearth of applicants in Copenhagen. This is comparable with the readiness with which Norwegians take service in Spitsbergen mines and illustrates the lure and fascination of the Arctic. Even its loneliness is an attraction. Mr. Waldo gives some good descriptions of the surrounding country, which serve to remind the reader that parts at least of Greenland have a rich vegetation and a smiling summer. The illustrations are excellent.

R. N. R. B.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

The Glacial Anticyclones. The Poles of the Atmospheric Circulation.—William Herbert Hobbs. With an Introduction by **Hugh Robert Mill.** New York: The Macmillan Co., Ltd. 1926. 9 × 6, pp. 198. *Illustrations and Maps.*

Had Prof. Hobbs been content with elaborating the theory of glacial anticyclones, the principle of which is now generally conceded as one among other factors in the circulation of the atmosphere, he would have made in this work a valuable contribution to meteorology, whether the theory actually originated with the author himself or not.

But he attempts to go further, and we are asked, in effect, to believe that the characteristic atmospheric circulation upon this planet would cease were it not that there chance to be two *dome-shaped* ice-caps, one situated around the South Pole, and the other, excentrically with respect to the North Pole, in Greenland, which act as down-shafts for the restoration of air to lower latitudes. The argument is plausible, but any reader abreast of the modern theory of the "Polar Front" (which Prof. Hobbs proposes to exchange for "Greenland Front") will soon discover that it depends on assumptions that are quite inconsistent with that theory. Much, for example, is made of the fact that atmospheric pressure is not especially high over the North Pole, but the significant fact that it is high relatively to the Icelandic and Bering Sea centres of low pressure is entirely suppressed, the fundamental law that air is guided from higher to lower pressure being ignored.

This attempt to prove that cold air does not drain out of the North Polar Basin but only off the Greenland ice-dome is backed up by an attempt to minimize the intensity of the winter cold at the North Pole with respect to that over the North American Continent even as far south as the United States. Whatever extremes of cold may be recorded in North America, no one knows the extremity of cold at the Pole, and as regards *mean* temperature, the well-founded estimate by Mohn of −40° F. or C. for the North Pole in January has no equal in the coldest parts of Canada, let alone the U.S.A. We are told, again, that on the shores of the Arctic Ocean hundreds of miles from the Pole, a northerly wind brings a higher temperature in winter than a southerly, the implication being that air from the pole is not particularly cold. But this is a purely *local* effect of a sudden transition from land-ice to sea-ice, or *vice versâ*, in accordance with a principle recently established by Dr. Pollog (see *Journal*, vol. **66**, p. 282). An outstanding fact, which we think fatal to Prof. Hobbs' theory that Greenland bears the entire brunt of feeding the cyclones

of the North Atlantic with cold air, is never once referred to or hinted at—the fact that whereas in the Southern Ocean summer is almost as stormy as winter, in both the North Pacific and North Atlantic winter is incomparably stormier than summer simply because the surrounding frozen continents enormously extend the reservoir of "polar" air. If Greenland were the sole or main source of cold air there would be no particular reason why June and July should not be as rough in the North Atlantic as December and January.

Prof. Hobbs seems to think that the observational evidence fails to warrant the prevalent idea that there are vast circum-polar cyclonic whirls, which he is unable, apparently, to coordinate with his Antarctic glacial anti-cyclone. Yet, in a masterly analysis, Dr. Jeffreys has recently demonstrated (*Q. J. R. Met. Soc.*, vol. 52, p. 85) that whatever superficial increase of pressure there may be over either pole or over Greenland, in consequence of the cold, this is a shallow surface effect, and that both poles are fundamentally seats of low pressure.

Any expert who reads this work with a critical eye will do so with profit, as there is a useful and instructive synopsis of the meteorological history of polar exploration, and the explanation given of the alimentation of the Greenland and Antarctic ice-sheets is probably, in part at least, correct. But the use of the book among uninitiated students is hardly to be recommended.

L. C. W. B.

GENERAL

The Statesman's Year-book.— **Sir John Scott Keltie and M. Epstein,** editors. London: Macmillan & Co. 1926. 7½ × 5, pp. xxxvi. + 1496. *Two Maps.* 20*s. net.*

The sixty-third publication of 'The Statesman's Year-book,' like the preceding issues, forms the most accurate and comprehensive account of the States of the world. Indeed, though this may well seem impossible, the 1926 volume appears to surpass the earlier issues in completeness.

The most important revisions and extensions are in the section on India and bear witness to the increasing attention given to the political entities of the country, since, for the first time, the British Provinces and the more or less independent states over which the Indian Government has certain rights are dealt with individually, and the data concerned with each collected under its distinctive heading instead of being scattered throughout the general account. This swells the Indian section to 59 pages, but gives increased readiness of reference. Among other interesting additions is the account of the International Institute of Agriculture, which gives details of its organization and shows the relationship existing between it and the League of Nations and the International Labour Office, with both of which it is in close collaboration. To the Introductory Tables are also added comparative statistics of the emigration from the British Isles to various parts of the Empire between 1908 and 1926, and a list of the European and North African Air Routes, while there are political maps of the Territories of the U.S.S.R. in Europe and Asia. But from so incomparable a collection of facts and interesting data it is clearly useless to attempt to select any for special mention.

B. H.

THE MONTHLY RECORD

A Memorial to Lord Curzon.

ALL Fellows of the Society which owes so great a debt of gratitude to the late Lord Curzon of Kedleston will be glad to know of the project for erecting to his memory a statue in or about Carlton House Terrace; and many will respond to the following appeal for funds to that purpose, which we publish with pleasure at the request of the signatories:

We, the undersigned, friends and colleagues of the late Lord Curzon of Kedleston, feel that London owes a tribute of honour to the life of public service which he gave to the Empire.

At different stages of his brilliant career he was called upon to fulfil, among other posts of responsibility, the offices of Secretary of State for Foreign Affairs, of Viceroy of India, of Leader of the House of Lords, of Chancellor of the University of Oxford, of President of the Royal Geographical Society, and of Trustee both of the British Museum and the National Gallery. Few men have brought to tasks so various and so exacting such diverse qualifications: width and wealth of culture, tireless industry, grace and dignity of bearing and address.

We think that services so faithful and so unique deserve to be permanently recorded, not only as an act of gratitude on the part of his contemporaries, but as an enduring example to posterity.

It is, therefore, proposed to ask the Dean of Westminster to grant space for a memorial plaque in the Abbey, and to obtain permission from the First Commissioner of Works to erect a full length statue near the house in Carlton House Terrace which was for so long his home.

Subscriptions, limited to five guineas, will be received and acknowledged either by the Hon. Secretary, Sir Ian Malcolm, at 57, Onslow Square, S.W.7, or by Messrs. Coutts & Co., 440, Strand, W.C.2. Cheques should be made payable to the "Curzon Memorial Fund."

STANLEY BALDWIN.	M. R. JAMES.
BALFOUR.	LANSDOWNE.
BIRKENHEAD.	A. D. LINDSAY.
RANDALL CANTUAR.	J. RAMSAY MACDONALD.
CAVE.	MIDLETON.
AUSTEN CHAMBERLAIN.	OXFORD.
DESBOROUGH.	F. W. PEMBER.
COSMO EBOR.	RONALDSHAY.
ESHER.	SALISBURY.
HARDINGE OF PENSHURST.	J. WELLS.

EUROPE

Origin of the Bath Springs.

Dr. R. H. Rastall has a "Note on the Geology of the Bath Springs" in the *Geological Magazine* for March 1926, in which he points out that the high temperature of the waters, about 120° F., their saline character and radioactive content, all combine to show that they rise from a great depth—of at least 5000 feet. The water is thus something very different from ordinary percolated rain-water, and since analysis of the various saline constituents indicates

proportions differing greatly from those found in sea-water, it is impossible to attribute the supply to percolation from marine sources. The springs appear, therefore, to be of deep-seated volcanic origin, and there is a great deal of direct geological evidence for this conclusion.

The city of Bath, on the eastern margin of the Somerset coalfield, is situated in the highly disturbed Mendip region, forming part of an ancient chain of folded rocks, which can be traced from the Belgian coalfield under Southern England and South Wales to the west of Ireland. Along this belt the older carboniferous rocks were much broken and contorted before the deposition of the Triassic surface deposits of Somersetshire, which are nearly undisturbed. This line of disturbance is met by another system of highly disturbed folded rocks of ancient date—the Malvern system trending north and south—and it is considered highly significant that the Bath springs rise just where the two lines of disturbance cross—likely to be a point of extra weakness. Chemical evidence derived from analysis of the deposits from the springs is entirely consistent with the geological evidence, but furnishes no direct support thereto on account of the difficulty of allowing for the effect on the character of the springs of the superficial beds through which the water flows. The ultimate source of the salts and radioactive constituents must undoubtedly be sought in the heated volcanic zone underlying the area at a great depth. It is a little strange that though Dr. Rastall refers to similar springs abroad as having a like origin, he does not mention the Buxton thermal waters, which are likewise associated with carboniferous limestone highly contorted in places by volcanic intrusions locally known as " toadstones."

Thermal springs are exceptional in England, and it is very difficult to obtain any such reliable information concerning their origin as Dr. Rastall affords.

Foreigners in Rural France.

Certain aspects of the problem of rural population in France are discussed by Mons. G. Mauco in the *Annales de Géographie* for March 1926. Between the years 1911 and 1923 the active agricultural population had decreased from 5,300,000 to 3,900,000. This tendency is reflected in the occupation of the land, for in approximately the same period the unproductive area had increased by 840,000 hectares, or over 20 per cent. This was naturally accompanied by a fall in the value of land. At the same time the birth-rate in France has fallen considerably, while in the neighbouring countries it is high. Consequently the immigration of foreigners into the agricultural regions has become very large. With a view to determining the extent to which the land has passed into the occupation of foreigners, the Ministry of Agriculture, on the initiative of M. Demangeon, started in 1921 an inquiry into the number of foreign farmers, freeholders, and tenants. Upon these returns the present article is based. Unfortunately they are very imperfect, and in some cases it is thought that the figures should be multiplied at least by three. The chief immigrant nationalities are Belgian, Swiss, Spanish, and Italian, 11,761 out of a total of 12,415. The number of Belgian occupiers is given as 5107, mainly in the northern departments, though a recent feature is a southward movement as far as the Oise. In keeping with local characteristics, their holdings are large. The majority are Flemish, hard-working and adaptable, their sole failures being in south-western France. The Belgian influx is probably now at its maximum. The Italian holders numbered 2265, and are chiefly found in the Midi. Previously they concentrated in the south-east, but since the war they have gone to the south-west,

where the opportunities for acquiring land have been greatest. The movement was largely fostered by agencies in connection with which certain abuses arose, so that the flow of immigrants has been checked. Those from northern Italy have proved efficient, and shown close affinities with the Gascons. The figures in these returns are much too low; there are probably 2500 in the south-west alone. The Spanish occupiers numbered 2821; they came into the south-west to make good the falling off of the Italian stream. Their characteristics are similar, except that many are not acquainted with up-to-date methods, the percentage of illiterates is high, and they are content with poorer accommodation. The Swiss numbered 1568, confined chiefly to the east: they are on the whole the best of the immigrants. Regarding the absorption of the various nationalities into the life of the country, the Belgian farmers are most at home, being in a region with close affinities with their own, and also living among 145,000 of their compatriots. The Swiss also are becoming assimilated, except perhaps in the centre. The Spaniards, who came originally as seasonal labourers, are also well spread throughout the population. The greatest percentage in any commune is 12. It is somewhat different with the Italians of the south-west. To a large extent settled by agencies and national societies, they have retained touch with each other, have reared large families, and possess their own newspapers and banks. The education of their children in the French schools, however, is countering this tendency to isolation.

This is but one phase of a far-reaching movement: its wider aspects are dealt with in a chapter in the 'Survey of International Affairs,' 1924, by Mr. A. J. Toynbee. It may be noted that there are probably 450,000 Poles working in French mines, factories, and fields, while the figures for Italian immigrants are also significant. In the years 1910 to 1914, the average Italian immigration into France was 70,000, or 25 per cent. of the total; for the years 1921–23 it was 104,000, or over 70 per cent. of the total Italian emigration to European countries.

Influence of the Baltic on Surrounding Vegetation.

A study by Dr. Karl Troll, entitled "Der Klimatische Einfluss der Ostsee auf die Vegetation ihrer Randländer," appears in Vd. **21** of the *Verhandlungen des Deutsch. Geographentages*, Breslau, 1925. It is introduced by a preliminary account of certain characteristic vegetation zones of Europe in relation to climatic factors, and then proceeds to show that the influence of the Baltic Sea on the vegetation of its shores is of quite a secondary order, the vegetation differing but little from what it would be in the absence of the sea, except within a narrow coastal belt 20 to 30 kilometres wide. Within this narrow belt diurnal sea breezes exert a considerable influence in the direction of climatic oceanity, as indicated in the vegetation. It is otherwise with the North Sea, Skagerrak, and Kattegat, which exert much more powerful oceanic effects in this neighbourhood. Thus, in South-West Sweden on the shores of the Kattegat, a sea well encompassed by land, oceanic heath vegetation is developed in a coastal belt 100 km. wide. The small oceanity effect of the Baltic Sea is shown to be due to its low salinity, which in parts is only about 10 per cent. as compared with 30 per cent. in the Skagerrak and Kattegat, and 35 per cent. in the North Sea. The surface of salt water is for various reasons more readily changed than fresh by vertical convection consequent upon changes of temperature, is more conservative of warmth and cold, and hence its mollifying effect on climate is more pronounced.

Dr. Troll's study is illustrated with maps showing the distribution in Europe of various species, including the heath (*Erica Tetralix*, L.), which, as already mentioned, is an oceanic type favoured much less by the Baltic than by the Kattegat. It is instructive to note that in a large map of Europe showing the distribution of vegetation as an *index* of oceanity the most oceanic region, comprising the British Isles, is styled the "Stechpalmen-Region" (holly), whereas the "Eichen-Region" (oak), in the special signification in question, is relegated to Western Russia.

ASIA

Swedish Explorations in Central Borneo.

Through the courtesy of the Foreign Office we have been favoured with the copy of a report on Dr. Eric Mjöberg's recent expedition in Central Borneo, sent from Batavia at the end of May to the *Straits Budget* and published in that paper for 3 June 1926. Dr. Mjöberg is a talented zoologist who has travelled extensively for natural history research in Australia, Sumatra, and elsewhere, and was for three years curator of the Sarawak Museum. Whilst resident in Sarawak he made a successful expedition to Mount Murud, in the northern part of the territory, and succeeded in reaching the top, which his predecessor, Mr. J. C. Moulton, had failed to do (see *Geogr. Review*, **15**, 1925, pp. 411–427, with map). On his latest expedition he left Samarinda, near the mouth of the Kutei or Mahakam River, in the eastern part of Dutch Borneo, on 3 September 1925, and ascended the Mahakam, experiencing the usual difficulties on account of the rapids. His plan was to ascend the Boh, a northern tributary of the Mahakam, and then cross the Baboin Mountains—the water-parting between the basins of the Mahakam and Kayan rivers—to the Apo Kayan country on the upper course of the latter. While carrying out this plan he met with a severe reverse through a sudden flood on the Boh, which caused a rise of 15 metres and the loss of two of the largest boats with much of the supply of rice. Dr. Mjöberg was thus forced to push on with four coolies over very rough and broken country to the Apo Kayan district, reaching the military station of Long Nawan almost worn out. Hence he sent back a party of 50 Kenyahs to take relief to the rearguard and bring on the outfit that had been left behind. From Long Nawan he pushed northward to the water-parting between Dutch territory and Sarawak in order to explore the unknown Mount Tibang, often referred to in native legend. This he succeeded in doing, ascending to the summit (1700 metres), and making a preliminary map of the surrounding country. It was found that there are two peaks of the same name and height not far from each other, one within Dutch territory, the other exactly on the divide. The mountain was found to be rich in animal and plant life, a sub-Alpine vegetation of Rhododendrons, etc., being found on the top. Rich ethnological collections were also made and the native beliefs studied. In January a return to the coast was made by the dangerous Kayan River, and the explorer safely reached Bulongan with collections reaching a total of 25,000 specimens. He also visited Maratua island and studied the big caves on the Birang river in the Berau district. An important result of the journey has been the establishment of the fact that we have a continuous mountain fauna along the central mountain chain, species once supposed to be endemic on Kinibalu being found also on Mounts Murud and Tibang. Dr. Mjöberg's field of work lay to the west and north-west of that of the Dutch expedition under Capt. Buys, lately described in the *Journal* (**66**, p. 567; **67**, p. 570), and between them the two explorers have greatly reduced the unknown area in the centre of the island.

Aerial Survey of the Tidal Forests of the Irrawaddy.

An interesting example of the utility of aerial surveys, apart from their topographical value, is furnished by an account, by Prof. L. Dudley Stamp, of the Irrawaddy Delta Survey in the *Journal of Ecology*, September 1925, based on the notes and observations of Messrs. A. W. Moodie, C. R. Robbins, and C. W. Scott. (A technical report on the operations, forming Burma Forest Bulletin No. 11, was noticed in the *Journal*, vol. 66, p. 455.) The tidal forests of the Irrawaddy delta, a valuable source of timber and fuel, were formed into Government Forest Reserves between 1895 and 1901. Through the nature of the delta no topographical survey could be carried out, and the exact value of the forests was unknown, as the edges and creeks of the delta are fringed by the worthless mangrove. The valuable tree is the Kanazo (*Heritiera fomes*). A preliminary survey was made and a working plan drawn up by Mr. A. W. Moodie in 1916, and the definitive operations were completed under the direction of Major R. C. Kemp in 1924, the photographs being taken at 10,000 feet on panchromatic quarter-plate negatives, giving a scale of 3·3 inches to the mile. From these photographs the Survey of India is compiling 4-inch-to-the-mile maps. The work yielded important and previously unascertained results in respect of vegetation cover. The forest areas of the delta are the product of various factors. Most of the water from the Irrawaddy passes through the central and eastern branches, so that here it is fresh or brackish, while to the west it is salt. Except for the sandy ridges thrown up by the waves and the ridge on which Rangoon stands, all the seaward half of the delta is flooded by spring tides. The greatest deposition takes place where the volumes of salt and fresh water are approximately equal. The level of the delta does not vary more than a few inches throughout. When a new deposit of alluvium is exposed, grasses appear first, and collect more mud and floating seeds, especially of the Kambala (*Sonneratia apetala*). The level of the bank, held together by the Kambala roots, gradually rises, the Kambala is killed, with the exception of a few vigorous specimens, and its place is taken by the Kanazo. While the perimeter is thus continually being raised, the interior may be flooded at every tide. The soil at the head of the delta is naturally coarser. The main factors are therefore level and salinity. Banks in fresh-water areas not flooded at any time carry the ordinary plains forest; those flooded only during the rains, and therefore by fresh water, have scrub forest or grass. The lower areas covered by salt water at spring tides are the upper limit for the typical tidal tree, the Kanazo, which thrives best where flooded daily. Where the mud is continuously covered by salt water the mangrove flourishes. The identification of most of these areas is as easy from the aerial photographs as from the ground. Two types are more easily distinguishable: the Kanazo forest with isolated Kambala, and the "byaik" or scrub areas. One type can be distinguished from the air by the colour of its foliage, but not from the photographs. In the contract for the survey it was stipulated that these should be taken between 10 a.m. and 3 p.m., so that the creeks should not be masked by shadows. Had they been taken when shadows were cast, identification would have been easier; while oblique photographs would also bring out the varying tree heights. Photographs from lower heights have no special advantage over enlargements of those from greater ones. Aerial photographs are useless for leafless trees, and give little clue to the nature of the undergrowth, while very mixed forests are difficult subjects. Emphasis is laid on the necessity for a careful study of a selected area from the ground

and from the air before a large-scale survey is carried out. The article is effectively illustrated by plates and diagrams.

AUSTRALASIA AND PACIFIC ISLANDS

Preservation of Vegetation of South Australia.

The dangers of uncontrolled exploitation of the forest resources of Australia are set forth by Sir Douglas Mawson in his Commemoration Address to the University of Adelaide in 1925. Though mainly concerned with South Australia, his points are of general application, and the value of forests in controlling water-flow, preserving a covering of humus, preventing "wash-outs," and re-establishing normal conditions in sand-dune areas, is widely recognized. He also emphasizes the fact that forestry is the complement of agriculture; that at present "absolute forest soils," that is, soils unfit for farming, are alone sufficient for schemes of reforestation; that the trees to some extent modify climatic conditions, and provide shelter for stock. In a wider sphere, much of the expenditure, for instance, on providing for the run-off in the Lower Torrens River, would probably have been unnecessary had the deforestation of the Mount Lofty Ranges been checked. However, partly because commercial interests have been affected by a shortage of domestic timber supplies, the necessity for afforestation in Australia is now recognized. For its size, South Australia is the largest importer of timber from outside the Commonwealth, the annual value of the import being of the approximate value of 1 million pounds sterling. Yet more than 800,000 acres in the State have the necessary rainfall for timber growing, and half of this area is in the Adelaide Hills, conveniently near the centre of demand. In the sandy soil of the south-east *Pinus insignis* thrives, but higher-grade timber, such as *Pinus laricio*, could be grown in the Mount Gambier region. That extensive afforestation would be profitable in itself is shown by the results of the Kuitpo Forest scheme. The total expenditure up to the present on one acre of *Pinus insignis* has been approximately £30; the value of the timber, plus that of thinnings already sold, is now £180. It has been announced that the Commonwealth Government is to establish a school of forestry at Canberra.

In South Australia, through the generosity of the owners of Koonamore sheep station, a vegetation reserve of 1500 acres has been established there in connection with the University of Adelaide. The work it is hoped to carry out there, and some general characteristics of the vegetation of arid Australia, are described by Dr. T. G. B. Osborn in the *Transactions and Proceedings* of the Royal Society of South Australia, vol. 49, 1925. As the drier areas are approached, eucalypts become of less importance, while scrubby acacia predominates increasingly. Thus the transition is from eucalypt forest through open savannah to mallee scrub, and finally to fringes of xerophytic eucalypts along the intermittent rivers. A prominent species of acacia is the "mulga," a canopy-topped tree rarely exceeding 5 metres in height, confined largely to hill slopes. On the dry plains the main vegetation type is the salt bush, a general term for slow annual or perennial species of *Atriplex*, *Rhagodia*, etc. The limit of the salt bush coincides roughly with the 15-inch isohyet. Despite irregular rainfall and heat (a fall of 0·15 inch is often ineffective), the dominant plants have established a delicate balance with the water relations, having low absolute transpiration and independence of diurnal variations. This adaptive capacity may account for the large number of species of arid plants. Human influences have affected the vegetation conditions considerably. Plant communities are in a regressive state through the depreda-

tions of grazing animals and vermin. The shrubby perennials are eaten as fodder during years of drought, and replaced by immigrants often useless for fodder. Woody plants, such as the mulga, are also failing to regenerate, seed production being the exception. If, amongst other things, supplies of fodder are to be maintained, and the soils protected as far as possible from erosion, there is much work to be done in studying arid conditions in the Koonamore Vegetation Reserve, which is suitably placed for the purpose.

POLAR REGIONS

Dr. Lauge Koch's New Greenland Expedition.

We are informed by the Foreign Office that, the material collected during his last expedition to North Greenland having now been put into shape, Dr. Lauge Koch has been entrusted by the Danish Government with a new research expedition, on which he started from Copenhagen on July 20 of this year. In a preliminary announcement of his plans two years ago (*Journal*, **64**, p. 426), Grant Land and other parts of Arctic Canada were spoken of as the probable sphere of operations. The ground actually chosen is, however, East Greenland, and it appears that he will spend the winter in the Scoresby Sound region (the site of the Eskimo Colony lately founded, see *Journal*, **67**, p. 381), and that he proposes to start thence next February, accompanied by three Greenlanders, on a sledge journey along the coast as far as Danmarks Haven. The main object will be geological research, the existence of fossils from most of the geological periods having been substantiated, though the collections so far made are not very extensive. Important mineral deposits are also thought to exist. After returning in June to Scoresby Sound (from a journey estimated to cover 2800 km. in all) Koch proposes to start on a traverse of the inland ice at or near its highest point, and to carry out glacial, meteorological, and seismological observations on the way. He will be joined by Prof. Harris of the University of Michigan, who will assist especially with the glacial work. He hopes to reach Disko bay in time to embark for Denmark early in September 1927.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Raised Beaches and River Terraces.

A committee has been appointed under the auspices of the International Geographical Union for the study of raised beaches and river terraces, with a special view to determining whether the existence of constant levels can be traced, and to fixing their succession, particularly on the coasts of Western Europe and the Mediterranean. The president of the Committee is Señor D. Eduardo Hernández-Pacheco, Professor of Geology at the University of Madrid, and the Secretary Dr. K. S. Sandford, of the Oxford University Museum, to whom all correspondence on the subject is to be addressed. It is hoped to issue a report not later than January 1928, that it may be in the hands of those taking part in the International Geographical Congress in July of that year.

Regions without Drainage to the Oceans.

Among the papers presented to the International Geographical Congress at Cairo last year, was one by Prof. E. de Martonne upon the areas of regions of interior drainage, accompanied by a map. These regions are due to abnormal conditions hydrographical or morphological: they are not therefore confined entirely to deserts. The former occur wherever evaporation exceeds

precipitation, *i.e.* in regions of feeble and irregular rainfall, high temperatures, and strong winds. Interior drainage areas of tectonic origin may be overcome by sufficient rainfall, or the progress of surface erosion may bring them into contact with the ocean. Previous attempts to calculate the total of these areas, generally confined to actual deserts, had been based upon a map in Berghaus' Atlas. Sir John Murray had estimated it at just over 20 per cent. of the total surface. Based upon the advance in cartography and scientific knowledge and a clearer analysis of the subject, M. de Martonne's map represents ten years' work under his direction at the Institut de Géographie de la Sorbonne. The final checking and the construction of the map was done by L. Aufrère. Areas shown with a fair network of rivers on maps of average scale have been considered to be well drained. Calcareous areas, such as the Karst, have not been shown as deserts. In doubtful cases, rainfall, temperature, and the impressions of explorers have been considered. Where, as does the Nile, a river passes through an arid region, the whole of its basin has not been represented as draining to the sea. Two types have been shown: the first without any precipitation; the second with slight precipitation which fails to reach the sea. Their areas have been calculated by the method of trapezes, and are given for each degree of latitude for the world and various sub-divisions. The total area without oceanic drainage approaches very nearly to 40 million sq. km., approximately 26 per cent. of the surface, or nearly 33 per cent. if the Polar regions are excluded. Of these 22 million sq. km. are totally lacking in run-off, *i.e.* evaporation exceeds precipitation. A study of the figures for different latitudes shows the predominance of climatic factors. Areas without drainage to the ocean are absent in high oceanic latitudes, and almost so around the Equator, their greatest extension being near the Tropics. The curve of percentage of interior drainage areas also follows that of average temperature in temperate regions, and that of rainfall in the hot regions. In one area examined by M. de Martonne—Eastern Asia and Australasia—the greatest extent of oceanic drainage occurs in low latitudes, from 20° N. to 10° S., by reason of the monsoon régime, while that without drainage lies beyond the Tropics. For the individual continents the percentage of the surface without drainage to the sea is: Europe, 22 (excluding the Volga basin, 11); North America, 10; South America, 14; Asia, 35; Africa, 50; Australia, 59.

GENERAL

The Imperial Institute and the Resources of the Empire.

The original object of the Imperial Institute was the investigation of raw products of the Empire and the development of commercial exchange in them. This is still its aim, though the work has been reorganized in accordance with the recommendations of the Ormsby-Gore Committee. The post of Director has been made an administrative one: Lieut.-General Sir William T. Furse, K.C.B., D.S.O., having been recently appointed. Samples of products submitted by officials and others from the Dominions and Colonies are examined by the technical staff to determine their potential commercial value, and their work is submitted to voluntary Advisory Councils or Committees of experts in the various branches, for a final report. The Plant and Animal Products Advisory Council is presided over by Sir David Prain; the Mineral Resources Advisory Council by Sir Richard Redmayne. Sample rooms containing comprehensive and systematically arranged samples of Imperial

products are maintained for the use of scientific and technical visitors. The educational side of the Institute's work has also been reorganized. The galleries are at present closed for redecoration and rearrangement of exhibits on a plan designed to attract public attention and utilize fully their educational value. This scheme has been drawn up in co-operation with educational authorities, teaching bodies, and chambers of commerce. Special features are the attraction of attention by realistic dioramas and models, supplemented by photographs, diagrams, etc., and the arrangement of the exhibits systematically, starting with world position and geographical features, and coming later to the economic products and the life of the people. Through the support of the New Zealand Government, the New Zealand Gallery has been practically completed on these lines. The publication of a monthly Bulletin to assist teachers is under consideration. A further development is the holding of exhibitions of the work of the British School of Rome Scholars, and also of artists of the Empire.

The Hydroplane of the Hamilton Rice Expedition, 1924–25.

We have been informed by Colonel Sir Henry Lyons, F.R.S., Director of the Science Museum, South Kensington, that the Curtiss Sea-gull hydroplane, used on Dr. Hamilton Rice's last expedition to the Amazon valley, and presented by him to the Museum, is now on view in Gallery VIII. A full account of the work of the hydroplane was given in the *Journal* for July last (pp. 27–43).

CORRESPONDENCE

Houses in Eastern Tibet

WHEN reading back numbers of the *Journal* I noticed some remarks by a former President on Tibetan houses which do not in every case apply to the architecture in regions between 28° to 34° N. and Long. 98° to 104° E.

The houses in the above districts are not all of the Egyptian type, although flat roofs are the rule. The structures in the Min and Wi valleys show indications of being an exception. The higher buildings, palaces, temples, and towers are here, as in western Tibet, of the Egyptian pattern mentioned, but in the ordinary dwellings the walls are built up with little if any difference in the thickness. In Chantui both types may be seen side by side. I suspect that the former may withstand the awful earthquakes better than the latter. Certainly, in Hor Drangu, during the earthquake in 1923, when almost every building collapsed, very high walls of mud, broad at the base and tapering towards the top, remained standing.

The earthquakes in this region occur about every ten or twenty years and practically level all buildings. The epicentres seem to be moving north-west in the Kanzè direction. The first serious one within thirty years was at T'ai Ning, 60 English miles from Tatsienlu; then about twenty years ago a similarly serious one shook Dawo, 35 miles f om T'ai Ning; and in 1923 another disastrous shock destroyed Hor Drangu and all the settlements to within 5 miles of Dawo. Hor Drangu is 40 miles from Dawo. In this last earthquake a French priest in a Mission station near the former settlement was killed in the ruins, with about 50 of his converts and adherents.

The houses are built of clay or stone. The inside mass of roofs, etc., rests on wooden pillars with stone blocks and foundations, and are easily shaken into a confused heap—that is, they collapse inside the stone or earth-work walls. But the strength of the "shake" of 1923 may be indicated by the fact that small shrubs were in places thrown out of position. In such places the earth was broken up into large squares and resembled a gigantic draught-board.

The use of clay and earth is very common along both the west and the north-west roads. The palaces of the princes in Litang, Batang, Hor Drangu, Chuwo, and Kanzè, if not Derge, are, if I remember correctly, built of clay or material other than stones. In some regions the clay is preferred, and it is not uncommon to see large squares or oblongs of this material in walls of stone. The clay seems to last as long as the stone. At Weichow the ruins of an imposing wall dates, according to tradition, as far back as 250 A.D.; but taking a hint from Du Halde, we might look upon it as the Eastern palace of the Tu Fan kings, and (approximately) refer it to 700 A.D. In this region also we find high slender towers—perhaps 100 feet—built of clay or a material resembling loess. A similar material abounds between Dawo and Kanzè.*

I very much doubt if the flat-roofed stone or clay dwellings originated on the Tibetan steppes. A tent-like ridge and not a walled quadrangle would accord better with climatic conditions. The flat-roofed house seems to have been in use for thousands of years in the contiguous valleys; and to-day the wall and house builders are natives of Mao Chow and the low Min regions which at the dawn of Chinese history composed the "Kingdom of the Ti." Judging also from numerous chipped stone implements found in the Tibetan valleys and on passes and plateaus up to 14,000 feet, we should conclude that the house builders came from the valleys.

Although these structures differ much in detail, a land with a scanty rainfall, without timber, but with abundance of clay and stone, may be suggested as the original control. Certain architectural peculiarities, as well as details in the dress of Tibetans and frontier tribes, would suggest a Han Dynasty influence. A comparison of Tibetan architecture, also, with imitation pillars, etc., on the Kia Ling caves might tend to confirm it. But while the Tibetans credit China and Nii Uyag † with giving them works of art and mathematics, laws and specimens of workmanship came from the north *viâ* "Hor and Yugera." The Hor still exist, vigorous and numerous, to-day around Kanzè and Drangu (see 'Jaeschke,' p. 511). The Hor may be the remains of the Yüeh Chī, who in their historic flight from the Huns disappeared in a southerly direction, instead of overrunning the kingdom of Græco-Bactria (Ta Hsia or Ta Ha) like their more enterprising compatriots.‡

The limit of house dwelling by Tibetans may be about 12,500 feet, which is the limit also of any but the hardiest of cereals. On the Litang plain, apart from the lamaseries and castles of the former princes, there are a few score of well-built dwellings of the non-Egyptian type. But we must explain the owners as retainers and other agents of the princes who came from much lower altitudes. The nomads who swarm over the Litang plain are tent dwellers. In June last year these were in sufficient numbers to control 60,000 sheep, 40,000 yaks, and

* Kanzè may be 180 English miles in a north-westerly direction from Tatsienlu.

† The region half circling Tatsienlu is now known as Minyag.

‡ Mentioned in Szema Chien's History of Ta Wau or Khōqand.

2000 horses. The number of savage dogs was not stated, and my vividly impressed imagination refrained from guessing.

J. HUSTON EDGAR.

"Jhuming"

With reference to Mr. Mill's paper in the April number of the Royal Geographical Society's *Journal*, I gather that he attributes the system of "Jhuming" to the fact that the soil is too poor to produce yearly crops; but is this the case? This system of cultivation extends eastward from Assam across northern Burma to the borders of China and northward to the edge of Tibet. In the Kachin and Black Maru countries of the 'Nmai Kha (eastern branch of the river Irrawaddy) the land is cultivated once only in five to eight years, the explanation given to me being that after one crop has been reaped, the ground becomes so choked with weeds, chiefly sedges and grasses, that it is easier to prepare a new piece of ground than to clear the old piece. As the jungle grows the trees and bushes gradually kill out the weeds, and when this is accomplished the ground is again ready for "jhuming," or, as it is called on the Burma side, for "Toungyah" clearing.

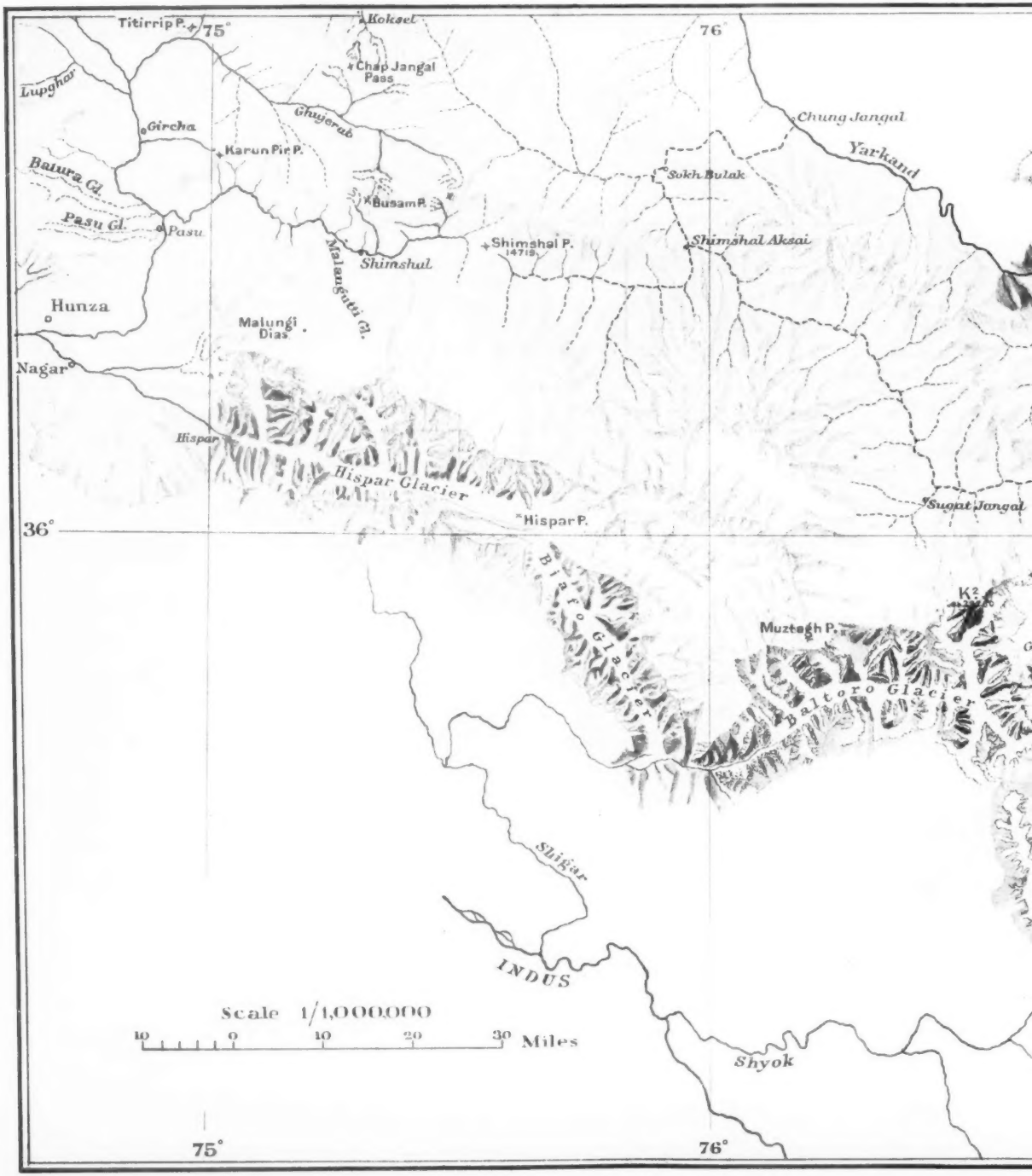
It would be interesting to have a sketch-map showing over what area of country this system of cultivation is in vogue; to the best of my recollection, it extends from the mountains forming the boundary of Burma and Assam as far as the valley of the Salween. I do not remember having met with it in the hills between Assam and Bhutan, nor in China or the Shan States.

Then, again, regarding the ethnography of these people. According to Kachin legends, the original home of man was Tibet. When the country became overpopulated the Creator sent for the headmen of the various tribes and told them they must migrate down the valleys of the following rivers, viz. Brahmaputra, Mali Kha, 'Nmai Kha, Salween, Mekong, Red River, and Yangtze Kiang, and to each headman he gave a separate language written on strips of parchment. The Kachins maintain that their forefathers lost their way in the snows, and dying of hunger boiled their strips of parchment to make soup. Hence they lost the art of writing and have never been able to regain it.

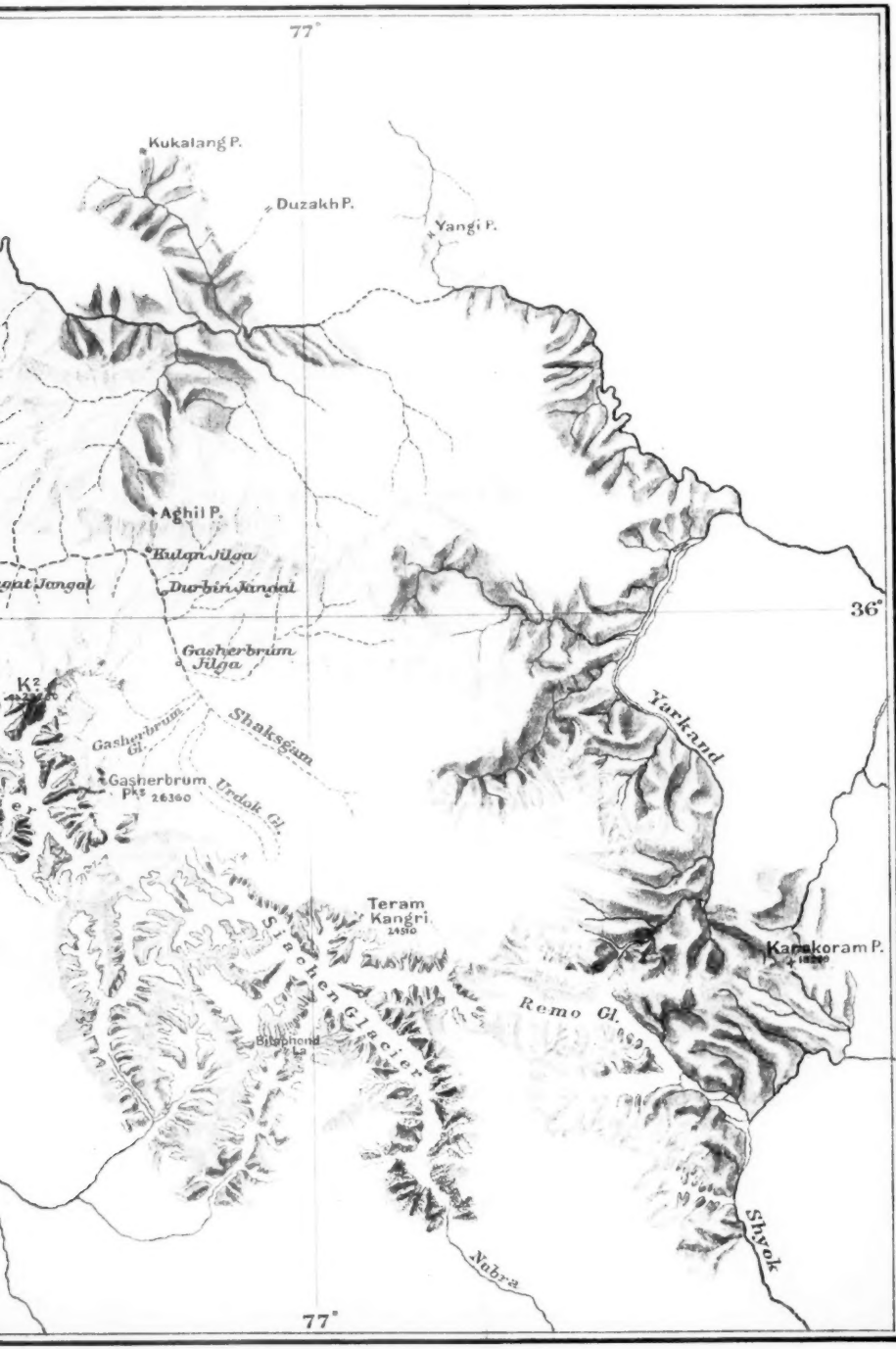
The main lines of migration down the above-mentioned rivers have been cut across by other migrations, such as that of the Shans to the Hukong Valley and the Chinpaw Kachins as far west as Sadiya in Assam, where they call themselves Singphos. I could make myself perfectly understood by the latter tribe, though they remarked from my accent that I must have learnt the language in Burma.

ELDRED POTTINGER,
Lieut.-Colonel (retired).

Map to illustrate SIR FRANCIS YOUNGHUSBAND'S paper: THE PROBLEM OF THE SHAKSGA



The main range and glaciers from the Surveys of Sir Martin Conway (1892), *the Duke of the Abruzzi* (1909), *Dr. T. G. L from the map of the Survey of India Detachment (Lt.-Col. H. Wood, R.E.) with the expedition of Dr. De Filippi* (1913– *including the reconnaissances of Sir Francis Younghusband. The work of the Visser expedition in Hunza* (1925) *was not a*



Dr. T. G. Longstaff (1909), *Dr. and Mrs. Workman* (1910); *the eastern and north-eastern areas ippi* (1913–14); *the lighter imperfectly surveyed areas from the maps of the Survey of India,*) *was not available when the drawing was made.*